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CONTENTS.

Editorial 201
Engineering Societies' Dinner at Boston 204
February Meeting of the New York Section of the Illuminating Engineering Society 204
Electric Club of Chicago 204
Water-Power Control in Wisconsin 205
Ohio Independent Telephone Situation 205
Electric-Lighting Franchise for Wheaton, Ill. 205
Mexican Electrical Developments 206
Edison Storage-Battery Patents 206
Monopoly, Competition and Standardization 207
Indirect Lighting Discussed at Chicago 208
Wisconsin Electrical Association Convention 209
Edison-Beach Electric Railway Car 212
Maryland Public Utilities Bill 213
New York Public Service Commission News 213
Massachusetts Legislative News 214
Massachusetts Commission News 214
American Electrical Engineers—III. George F. Sever 214
Current News and Notes 215
Transmission Lines of the Central Colorado Power Company 217
A Large Industrial Plant Switchboard—I. By Warren H. Miller 221
Determination of Constants of Instrument Transformers. By F. A. Laws 223
The Electric Motor in Printing Work. By S. H. Sharpsteen 224
Sixty-six Gasoline Plants Displaced in Denver 226
London Central-Station Publicity Scheme 227
Court Construction of Electric Lighting Franchise 227
Effect of Tungsten Lamp Introduction in Quincy, Mass. 227
An English Solution of the Contractor vs. Central-Station Situation 228
Increase in Central-Station Service at Worcester, Mass. 228
Billboard Lighting in Denver 228
The Calculation of Voltages for a Special Arrangement of Incandescent Lamps. By Roscoe Scott 228
Tungsten Street Arches at Hobart, Okla. By G. E. Miles 229
An Economical Arrangement for Store Lighting 230
Digest of Current Electrical Literature 230
New Apparatus and Appliances 236
Industrial and Commercial News 241
General News 245
Weekly Record of Electrical Plants 251

NATIONAL ENGINEERING STANDARDIZATION.

The address, printed elsewhere, which was delivered last week by Mr. George Westinghouse, at a dinner in Boston given under the auspices of national and local engineering societies, is a highly interesting and important discussion of industrial questions now looming large before the country, and also touches on others that are yet in the future. We wish here to direct attention particularly to the suggestion of Mr. Westinghouse that the various engineering societies should co-operate in the organization of a well-equipped and ably-officered bureau, having for its purpose the consideration of questions relating to engineering standardization. The desirability of standardization wherever this will reduce the cost to the consumer, is a fundamental precept of economics, and its industrial need in certain electrical lines has long been a crying one. The work in standardization that has been accomplished by the associations of railroad master mechanics and car builders forms one of the most important chapters in the history of our steam railroad development. It is true that the American Street & Interurban Railway Association has similarly dealt with some of the mechanical details of electric cars, that the Engine Builders' Association has brought about a standardization of some details of direct-connected generating units which concern both the engine builder and the electrical manufacturer, and that the standardization work of the American Institute of Electrical Engineers has, to some extent, an industrial character. But, in view of what might be done, standardization in the electrical field has, as pointed out by Mr. Westinghouse, been woefully lacking in the recognition that its importance demands. While the suggestion of Mr. Westinghouse is not confined to electrical manufactures, the plan of co-operation outlined would not prevent the national bodies representing the electrical industry from having their joint committee take up for independent study matters affecting only that industry, though it might be well, in the interest of conservatism, to have all final action subject to the endorsement of the general committee. Happily, the work of organizing a body such as that suggested, will be much facilitated owing to the precedents available through the work of the Engineering Standard Committee of Great Britain. This committee was organized in 1901, and consists of, first, a main committee, the members of which are nominated by various national engineering societies, one being the Institution of Electrical Engineers. Under the main committee there are 12 sectional committees and 26 sub-committees with a total membership of 265—the sectional committee for electrical applications having nine sub-committees representing various electrical branches. A large number of reports have been published, standards have been fixed in various lines of engineering, and the work of the body still continues. The funds for meeting expenses are supplied jointly by the British Government, the various societies represented, and by railroad and manufacturing companies. It is most earnestly to be hoped that early consideration of the suggested American organization for engineering standardization will be given by the bodies represented at the Boston meet-

ing, with a view to bringing the matter in some definite form before the other societies that should be interested, as well as to the attention of representatives of the various manufacturing interests that would be beneficiaries of the proposed work.

THE WISCONSIN CONVENTION.

The officers of electric railway and lighting companies in Wisconsin, forming the Wisconsin Electrical Association, which held such a successful convention at Milwaukee last week, are at last to be congratulated on the starting of a consolidated association in that State and the wiping out of the unfortunate condition of affairs which has existed in connection with the old Northwestern Electrical Association for several years past. While the Northwestern Association had been holding reasonably successful conventions each winter, its financial condition was almost hopeless on account of old debts, and its membership records were in equally bad shape. As we have pointed out for many years, this association had become practically a Wisconsin association long before it became that in name by the consolidation of last summer. The Wisconsin Electric & Interurban Railway Association, which was the other party to the consolidation, was in a thrifty condition, but its usefulness was somewhat impaired by the existence of a similar association in the same State. The Wisconsin Electrical Association is now on a thoroughly satisfactory basis and this is convincingly shown by the representation of over 50 operating companies at Milwaukee last week. The discussions of operating and financial questions were as live and full of meat as one could desire. Questions connected with franchises, valuations of properties and depreciation naturally received much attention, because Wisconsin is now rapidly adjusting itself to the new conditions brought about by the public-utility bill and the commission created by it. Depreciation is receiving more serious consideration than ever before, as the Wisconsin Commission is forcing companies to make proper recognition of this item in their accounts. The moral effect of the well-known attitude of the Milwaukee Electric Railway & Light Company in providing for depreciation more wisely than many other companies, has caused the subject to be more seriously considered in Wisconsin than in other States.

SOME REMARKABLE HIGH-VOLTAGE WORK.

The Central Colorado Power System is well known to our readers as one of the most important of the great Western networks, and we present in the present issue some account of the interesting and successful work which it has done in transmitting large amounts of power under exceptionally difficult conditions and at very high voltage. The plant considered transmits, in fact, energy at 100,000 volts over the Rocky Mountains up to a maximum altitude of 13,700 ft. and over a distance exceeding 150 miles. The lines are exposed, not only to the ordinary contingencies of wind and snow, but to sleet conditions which are exceptionally severe. The sleet recorded in the region has reached a diameter as high as 6 in., a condition quite unheard of in most sections of the country. Success has been obtained by very thorough and skillful tower construction, together with the use of suspension insulators, which are undoubtedly a very considerable factor in the success of the installation. The average spacing of the towers is about 750 ft., and they carry three hemp-core cables of No. 0 equivalent. These cables are supported on a single top cross-arm in a horizontal plane, the distance between the conductors being 10 ft. 4 in. The insulators are four suspension disks, each of which is rated at 25,000 volts working pressure. The suspension insulator has been the greatest recent improvement in the electrical transmission of energy, and this line, subjected as it is to enormous strains, is an admirable example of the success of the device. The towers are not high, the normal height of the conductors at the tower being only 40 ft. This gives unusual stability to the line, a stability which is greatly needed in winter. The lightning protection consists of a galvanized steel stranded cable, or sometimes a pair of them, carried at the level of the upper cross-arm and supported directly on the tower structures. This protection runs over a considerable part of the route, especially the portions most exposed from their situation to the danger of lightning. The results have been satisfactory, although no lightning arresters were installed, and no damage was caused to the line or apparatus by lightning during the entire summer service, the only delay being that due to putting in apparatus temporarily cut out by the oil switches on account of induced surges. Altogether, the results of eight months' operation at from 86,000 to 100,000 volts has been highly successful. Here is another proof of the fact we have often noted, that engineers have been in the past more scared than hurt in the matter of high voltage. As each forward step has been taken, dangers seriously feared have generally proved to be mythical, which is a good augury for further improvements.

THE CONSTANTS OF INSTRUMENT TRANSFORMERS.

Although the assumption is frequently made that the voltage ratio in a shunt transformer and the current ratio in a series transformer are equal directly and inversely to the ratio of primary and secondary turns, it is well known that the relation here expressed is merely approximate. For most engineering purposes the actual ratio is so close to the assumed ratio that no appreciable error is attributable to the assumption. The conditions are quite different, however, when dealing with instrument transformers. Not only should the exact voltage ratio of the shunt transformer be known with a high degree of accuracy, but the time-phase displacement of the secondary from the primary voltage should also be known; in the case of this instrument transformer the discrepancy between the actual ratio and the one frequently assumed is attributable largely to the local primary and secondary impedances, while the exciting current has a negligible effect. In a series instrument transformer it is essential in all cases for the ratio of the two currents to be known, and when the transformer is used with wattmeters, watt-hour meters and power-factor meters, it is necessary to know the angle of time-phase displacement between the primary and the secondary currents; in this transformer the ratio actually obtained differs from the ratio of turns, and the time-phase displacement differs from 180 deg., largely on account of the exciting current, while the local impedances of the coils are of minor importance.

A method for determining the current ratio of a series transformer involving the use of the potentiometer principle is outlined in an article elsewhere in this issue by Prof. F. A. Laws. The method is similar to, but represents an improvement upon, a method described in our issue of Oct. 28, 1909. In each of the methods, both the secondary current and the primary current of the transformer are passed through resist-

ances having values such that the resistance drop of the primary current is equal to the resistance drop of the secondary current, and from the known values of the resistances, the ratio of the currents is determined. In each case special means are employed for compensating for the time-phase displacement of the primary from the secondary current. In the earlier article, the primary and secondary circuit resistance drops were equated in such a way that their vector difference was in time-quadrature with one of them, in which case the current ratios were determined from the quantities just given, while the time-phase displacement was calculated from the value of the vector difference. In the method described in the present issue, use is made of a phase shifter, by means of which current in any desired relative time-phase may be obtained for one coil of the detector dynamometer employed for showing when the vector difference between the primary and secondary circuit resistance drops is in time-quadrature with one of the drops. The author also describes a special form of strip electrodynamometer which has proved well adapted for detecting a true time-quadrature relation between the two currents in its coils. The method and apparatus discussed by Professor Laws should prove convenient for use where many series transformers are to be tested with the minimum expenditure of time and labor.

RECORDING VOLTMETERS AND AMMETERS.

As noted in the Digest, the *Elektrotechnische Zeitschrift* has recently published an article, by Herr Ernest Rühle, upon recording voltmeters and ammeters in industrial service. The instruments described record with a pen on a moving band of paper, either volts or amperes, to curvilinear ordinates, against time in rectilinear abscissas. The record, therefore, indicates the history either of the voltage or of the current in the particular circuit to which the instrument is connected. Of course, there is nothing remarkable at this date in an instrument capable of performing one of the above functions. The article lays particular stress on the utility of such instruments, and on the importance of their more general introduction. Recording voltmeters are always more difficult to employ satisfactorily, because they are of very little use unless they are both sensitive to small changes of voltage, and also remain in accurate calibration to within one volt or less. The records of such instruments are often useful, not merely for indicating the range of fluctuation of voltage in a distributing network, but also for indicating the nature of the fluctuations, as to suddenness, protractedness and frequency. The cause of the fluctuation can often be determined from an examination into these points of behavior, with a reasonable expectation either of removing or of minimizing such as may be serious. The degree of damping, or deadbeatness, is an important consideration in the operation of all such instruments. They should be strictly aperiodic as far as possible, neither overshooting the mark on the one hand, when thrown on suddenly, nor undershooting and lacking in promptitude on the other.

DAYLIGHT EFFICIENCY OF ILLUMINANTS.

A recent paper by Dr. Ives, in the *Bulletin* of the Bureau of Standards, gives some interesting data on the white-light or daylight efficiency of illuminants, meaning by this the proportion of white light available from any source with respect to the total intensity of that source. It is, in fact, a measure of the amount of daylight color that can be obtained from various illuminants by suitable screening. As is very well known, most artificial illuminants vary somewhat widely from white, and it is sometimes highly desirable for the purpose of color discrimination to be able to reduce the light from the available source to a proper daylight value. This can be done after the method suggested by Nichols in obtaining a normal white in the acetylene flame. For most ordinary illuminants a bluish screen is required to reduce the other colors to a suitable proportion with the transmitted blue. It is an old scheme and a rather good one when scientifically carried out. Thirty years ago or more some forgotton investigator brought out a blue glass chimney for kerosene lamps which was intended to do this very thing, and had for a time a considerable sale. Just how good it was from the spectrophotometric standpoint there is no way of telling, for the last of these chimneys was probably broken years ago; but the general effect indicated a fair amount of success in balancing the color.

Dr. Ives' data include acetylene, Welsbach mantles, and the usual varieties of electric incandescent lamps. A good deal of screening is necessary with any of these to produce a daylight color, the tungsten lamp, for example, having, when suitably screened, a "daylight efficiency" of between 4 and 5 watts per mean spherical candle. Acetylene and Welsbachs require relatively somewhat less screening, although the latter would, of course, be open to the objection that the color of its light does not stay constant, the green becoming more prominent as the burner ages. The ordinary carbon incandescent lamp is out of the running, being hopelessly handicapped by the relatively very small amount of blue, on account of which the absorption of red and green has to be abnormally big. The Nernst lamp was unfortunately not tested. It probably would have approximated the results obtained from the tungsten lamp as regards screening. A more serious omission is that of the electric arc, particularly of the intensified carbon arc, which comes certainly very much nearer to normal daylight than any of the illuminants which Dr. Ives studied. The enclosed arc also would probably have made a good showing in efficiency owing to the fact that the screening required to cut off the superfluity of blue, which exists in this type of arc, probably would not greatly reduce the efficiency.

It is theoretically possible to reduce any incandescent illuminant to daylight value by proper screening, but the actual working out of the screens required would in some instances involve much difficulty owing to the fact that most screens tend to produce local rather than generalized absorption. For the yellowish lights, a light-blue glass answers fairly well, and by its use one could get a beautiful white from the tungsten lamps at an efficiency quite as good as that of the carbon lamp in ordinary use. The author also goes into the matter of white sensation efficiency as regards general effect of light, which is quite a different thing from color-matching efficiency, the latter being more important from a commercial standpoint. As an outcome of these investigations it should be possible to produce a standard color screen, which, for example, would give a normal daylight effect when used in combination with a tungsten lamp. Such a standard would be very desirable for technical purposes, and we trust that Dr. Ives will find it convenient to produce one.

Engineering Societies' Dinner at Boston.

Five hundred members and guests of the Boston Society of Civil Engineers, the Boston Section of the American Institute of Electrical Engineers, and the Boston branch of the American Society of Mechanical Engineers gathered at the Hotel Somerset, Boston, on Friday evening, Jan. 21, to attend a banquet and meeting to promote the interest of all engineers in Boston and vicinity, and to welcome to the city as guests Mr. George Westinghouse, president of the American Society of Mechanical Engineers; Mr. John A. Bensel, president of the American Society of Civil Engineers; Mr. L. B. Stillwell, president of the American Institute of Electrical Engineers, and President George B. Francis, of the Boston Society of Civil Engineers. The dinner was one of the most representative which has ever been held in New England professional circles, and the occasion was the first in which the different branches of engineering have met on a common basis of technical sympathy and friendship. Considerable enthusiasm was developed at the meeting which followed the banquet, in connection with a proposition of a clubhouse in Boston to shelter the engineering, architectural and kindred societies, and a joint committee was appointed to consider the matter in detail.

Prior to the banquet a reception was held in the parlors of the hotel, the receiving party consisting of Presidents Westinghouse, Stillwell, Francis and Bensel. The dinner was held in the ballroom, and at its conclusion, Prof. Ira N. Hollis, of Harvard University, chairman of the committee of arrangements, called the meeting to order, stating that in addition to the presence of the heads of the three national organizations, the guests included the presidents of 16 other engineering and scientific societies or institutions. He then introduced Mr. Charles B. Edwards, of the Fore River Shipbuilding Company, Quincy, Mass., who gave a most interesting illustrated talk upon "The Main and Auxiliary Machinery of the Battleship *North Dakota*." The dynamo plant consists of four 300-kw sets, turbine-driven, occupying a space 42 ft. long by 20 ft. wide. All the machine tools in the repair shop are driven by separate motors. There are four 36-in. and four 60-in. searchlights. In conclusion Mr. Edwards stated that the increase in power required for speed increases is noteworthy. From 12 knots to 12.5 knots the increase is 46 hp; from 19 knots to 19.5 knots the increase is 1620 hp; and from 21 knots to 21.5 knots the increase is 4400 hp.

President Francis, of the Boston Society of Civil Engineers, reviewed the influence of the engineer in the upbuilding of the country, and voiced the desirability of a clubhouse for the engineering profession in Boston and its vicinity. About 5000 men are located in the Boston district who would be directly interested in such a plan. He suggested the formation of a stock company to be known as the Boston Engineers' Club, but urged the importance of first deciding upon a general plan before taking up details. President John A. Bensel, of the American Society of Civil Engineers, also spoke in favor of a clubhouse. President L. B. Stillwell, of the American Institute of Electrical Engineers, spoke in a congratulatory vein to the other two national societies upon their new presidents. He said that co-operation is the basis of true progress, and that the willingness of men to merge their individualities accounts in large part for the success of American works of magnitude. He closed with a glowing tribute to Mr. Westinghouse and his influence upon those who have been associated with him. President R. Clipston Sturgis, of the Boston Society of Architects, spoke of the dissipation of the old spirit of jealousy between architects and engineers and intimated the co-operation of his society in the clubhouse plan. Mr. Charles Francis Adams, former chairman of the Massachusetts Railroad Commission, gave reminiscences of his early association with Mr. Westinghouse.

Mr. Westinghouse was given a great ovation when he rose to speak upon "Monopoly, Competition and Standardization." A report of Mr. Westinghouse's address is printed elsewhere. The committee on arrangements of the very successful meeting consisted of Prof. I. N. Hollis, chairman; Prof. Edward F. Miller and Mr. J. H. Libbey, for the American Society of Mechanical Engineers; Messrs. H. F. Bryant and F. H. Fay, for the Boston Society of Civil Engineers; and Messrs. N. J. Neall and J. F. Vaughan, for the American Institute of Electrical Engineers.

February Meeting of the New York Section of the Illuminating Engineering Society.

Two papers were read and discussed at the meeting of the New York Section of the Illuminating Engineering Society held at the Engineering Societies Building on Jan. 20. The first paper was one by Mr. Thomas W. Rolph, dealing with the lighting of a bowling alley. The alley described was lighted by means of a row of eight 40-watt tungsten lamps in steel reflectors. The mean illumination over the 210 sq. ft. of area was 1.05 ft-candles with an illumination of 2.62 ft.-candles at the pins.

The second paper was presented by Mr. T. I. Jones, who discussed the selling of electric energy for lighting. He showed the effect of the load factor upon the cost of generating electrical energy and explained the necessity for the equivalent of a readiness-to-serve charge in determining the rates for electrical energy. On a meter basis the charges for energy for motor service, made by the Edison Electric Illuminating Company of Brooklyn, are based on 10 cents per kw-hour for the first 25 hours' use of the equipment per month, 5 cents per kw-hour for the next 25 hours' use and 3 cents per kw-hour for all additional energy used during the month. The flat rate has proved advantageous for sign lighting. This rate is $2.75 per year for each 4-cp lamp and $4 per year for each 8-cp lamp; the lamps are of the tungsten type supplied and maintained by the company and are controlled by a switch closed at dusk and opened at midnight by a representative of the company.

In discussing the paper by Mr. Jones, Mr. J. D. Israel claimed that the chief requirement for successful salesmanship in the electric lighting business is ability to sell to each customer only that with which he will be satisfied.

Mr. R. S. Hale stated that only when the district representatives of an electric lighting company are transferred at certain intervals can the best results be obtained.

Mr. C. A. Littlefield expressed his dislike for any minimum charge for central-station service, claiming the greater satisfaction would be obtained if there were nothing to be mistaken for discrimination.

Mr. H. W. Moses said that excellent results had been accomplished in Boston by establishing an illuminating engineering department connected with the Edison Electric Illuminating Company. The tungsten lamp has proved of much assistance in popularizing electric service.

Electric Club of Chicago.

According to the by-laws, the nominations for the annual election of officers for the Electric Club, of Chicago, were made at the meeting of Jan. 19. A nominating committee consisting of Messrs. A L. Millard, W. R. Bonham and W. S. Taussig reported the following "slate": President, Mr. Frederic P. Vose; vice-president, Mr. Homer E. Niesz; secretary, Mr. F. S. Hickok; treasurer, Mr. F. J. Postel; managers, Messrs. A. A. Gray, W. E. Keily, George H. Porter, Robert S. Mitten and E. R. Rockwell.

The report of the committee was read by Mr. Gray on request, and President Vose announced as the tellers of election Messrs. J. N. Macalister, E. F. Smith and George H. Lounsbery. The election will be held on Feb. 2. The meeting was held in the basement of the Coliseum during the Electrical Show, and Mr. H. E. Niesz, who is the manager of the show, explained the purposes of the exhibition. Mr. Frank L. Perry also spoke briefly about the aeronautical work of Lieut. Ben. D. Foulois, of the Signal Service of the United States Army, who was the principal speaker of the meeting.

Water-Power Control in Wisconsin.

The legislative committee on water-powers, forestry and drainage, appointed at the last session of the Wisconsin Legislature to investigate the State's water-power resources and to recommend a method of control, has been so far unable to reach any agreement. There are three opinions held by the members of the committee, one element standing for broad control, another for qualified control, and another for perfunctory control. The first method of control gives the State the right to develop the power, fix rates, etc., placing the question on the basis of public utility. It is stated that on account of the difference of opinion within the committee, at least two reports will probably be made. The members of the committee are: Senators H. P. Bird, Paul O. Husting and Henry Krumrey; Assemblymen W. M. Bray, George P. Hambrecht, J. E. Thomas and F. W. Kubasta.

Ohio Independent Telephone Situation.

Mr. Frank A. Davis, of Columbus, president of the United States Telephone Company, returned from New York a few days ago, where he had been in consultation with the members of the firm of J. P. Morgan & Company relative to the betterments and extensions of the properties recently acquired by them. Mr. Davies had nothing further than these matters to report, with the exception that the headquarters of the United States Telephone Company will be moved to Columbus within a short time. He said that there would be no changes in the operating staff, as the personnel is satisfactory in every way. The change in the location of the office will be made for the convenience of Mr. Davis, who is a resident of Columbus. Cleveland has for years been the headquarters of the independent movement, but the recent changes made in the ownership of some of the principal companies makes a change in matters and in all probability it will be permanent.

It is reported that the Central Union Telephone Company has all the engineers that can be secured appraising and preparing reports on the exchanges in the small towns of the State and that within a short time a large number of changes will be announced. The report is to the effect that the company is preparing to carry out its plans announced some months ago of withdrawing from many of the small places and turning its local business over to the independent companies and receiving in return the long-distance business of these companies for the American Telephone & Telegraph Company. Should this be true, a number of such changes may be announced within a short time. It is known that the Bell long-distance lines have already been connected with a number of the local independent exchanges, especially where the rates have been seriously affected by the recent advances made by the United States Telephone Company.

Coincident with this report, however, Mr. Frank L. Beam, president and manager of the Ohio Independent Telephone Association, is quoted in a Columbus paper as saying that all the small independent companies in the State are in fine shape relative to both financial and physical condition. They are making money and increasing their business, he reports, then adds that he does not believe that the entrance of J. P. Morgan & Company into the telephone field will change the aspect as some people believe. He says he thinks the companies which the firm control will be operated as independents and that all are sincere in what they say.

Mr. H. B. McGraw, attorney for the stockholders of the independent companies, who are protesting against the control of J. P. Morgan & Company, will shortly go to New York to take the depositions of Mr. Morgan and his associates, as well as the officers and attorneys of the American Telephone & Telegraph Company. Attorneys both for the firm and the company at this end of the line have promised to ascertain whether the men will testify voluntarily or whether it will be necessary to secure subpœnas for them. Mr. McGraw has invited Attorney-General Denman to accompany him on this trip in order that he may secure whatever information he needs for his department, in case he should decide to bring suit to prevent the merger feared by his clients.

The situation regarding telephones may be somewhat affected if a bill prepared at Columbus is enacted into a law by the General Assembly. It will provide for an interchange of business between telephone and telegraph companies in order that all points served by any company may be reached by a customer. This law will apply also to an interchange of business or service between railroads, interurban roads, electric light plants and other public utilities, all of which will be under the superintendence of a commission which will correspond with the present railroad commission except that it will have much broader and more extended authority.

Mr. E. G. Tillotson will in all probability resign the presidency of the Cuyahoga Telephone Company of Cleveland within a short time to enter the bond business as a member of the firm of Tillotson & Wolcott, which was formed some time ago. It is also said that he has formed a new bank connection which will take much of his time. He was for years a banker and naturally gravitates back to that line. The annual meeting of the company will be held late in April when, it is said, Charles A. Otis, of Otis & Hough, bankers and brokers, will be elected president of the company. Mr. Otis has not yet confirmed this, but has said that he expects to remain on the board of directors and that he is satisfied that the property will be operated as an independent or that he would not have any connection with it.

Electric-Lighting Franchise for Wheaton, Ill.

Wheaton, Ill., is a little city 25 miles west of Chicago, which has its own electric distribution system, but purchases electrical energy from the Du Page County Electric Light & Power Company under contract. The city authorities, under the leadership of Mayor H. A. Schryver, have recently arranged to put the franchise for electrical service in that city up at auction to be sold to the highest and most responsible bidder, at the council chambers in Wheaton, at 2 p. m., on Feb. 5, 1910. The cause of dissatisfaction with the existing supply of electricity, according to a formal resolution of the City Council, is that the price which the city is obliged to pay for the electricity purchased under the contract "is such that it is impossible to sell the same to the private consumers in said city at as low a price as prevails in many, if not most, cities in Illinois." No bid will be considered which is less than $20,000.

A proposed ordinance has been prepared which the successful bidder is asked to accept. The company will be granted the necessary permission to use the streets and shall install for each consumer, free of expense, a meter of standard make and accuracy. In extending its lines the company shall be given at least one customer to each 500 ft. of extension. Twenty-four-hour service shall be given. The company agrees to purchase from the city the distribution system now maintained at an agreed price. The company is to receive $60 a year for each 6.6-amp street arc lamp for all-night service or $50 a year for lamps operated on moonlight schedule. The city reserves the right to change from the prescribed arc lamps for street lighting to other electric lamps by giving six months' notice, the rates to be changed in proportion to the amount of energy consumed.

The kw-hour rate for electrical energy supplied to the consumers by the company shall be 12 cents, subject to a discount of 2 cents for prompt payment and a further discount of 2 cents where 100 or more kw-hours are consumed in any one month, provided that the net bill for a consumption of between 80 and 100 kw-hours during the month shall be $8 or more and also provided that where less than 10 kw-hours are consumed in a month a charge of $1.20 may be made, with a discount of 20 cents for prompt payment. If the consumer elects, a maximum-demand rate shall apply in place of the kw-hour rate. By his plan there shall be a fixed monthly charge irrespective of the energy consumed, to which shall be added a

consumption charge of 4 cents per kw-hour for the energy used. This consumption charge is subject to certain discounts; for instance, where the consumption charge is six times the maximum demand, a discount of 1.5 cents per kw-hour is made, reducing the price, therefore, to 2.5 cents per kw-hour. The monthly maximum-demand charge for motor or heater service is to be $1 for each horse-power or fraction. For lighting installations the rate shall be 15 cents for each 16-cp lamp or its equivalent, arc lamps to be figured at $1.50 each. When the maximum-demand rate is chosen, the minimum bill to be charged will be $3 a month.

It is provided that at the expiration of 10 years a readjustment of rates may be made. The proposed franchise is to be for 30 years, but the city shall have the right to purchase the system at the end of 20 years. The electricity to be furnished under the proposed contract shall be at 110 volts, with a variation in e.m.f. not to exceed 2 per cent, but it does not seem to be stipulated whether alternating current or direct current shall be used. There are many other provisions in the ordinance, which is unusually elaborate for a city the size of Wheaton.

Mexican Electrical Developments.

It is authoritatively announced that the Mexican Light & Power Company will enter the great Pachuca mining and industrial district by means of a transmission line which it will build from its great Necaxa plant. The company has entered into a contract with the Compania Hidro-Electrica y Irrigador, of Pachuca, by which the latter is to become the distributing agency of the power that will be brought to the district from Necaxa. The transmission line will be finished and 30,000 hp available for that district by Aug. 1, it is stated. The Compania Hidro-Electrica y Irrigador owns two hydroelectric plants and is erecting a third, all in the Pachuca district. When its third plant is finished it will have about 15,000 hp available, it is announced. It is already furnishing mines and industrial plants with power. This contract between the two companies is regarded as equivalent to a merger of the competing interests.

The government of the State of Hidalgo has granted a concession to the Compania Empresa Irrigador de la Vega de Metzitlan, of Pachuca, for the erection of a hydroelectric plant and the utilization of the waters of Metzitlan Lake for generating electric power and for irrigation purposes. The company will transmit the power to the mining districts of El Chico and Real del Monte.

The site for the proposed great dam that is to be built by the Federal Government across the Nazas River in Northern Mexico at an estimated cost of $12,000,000 Mexican currency has been selected and the surveys and estimates are in the hands of the department of fomento for official approval. The contract for this great structure is held by the British firm of S. Pearson & Son, Ltd. While the primary object of the proposed dam is to form a great water storage reservoir for irrigation purposes, it is announced that the water will also be utilized to generate electric power. This power will be distributed by means of electric transmission lines to the cities of Torreon, Durango, Lerdo, Gomez Palacio, Mapimi, San Pedro and a number of other smaller places.

Mr. David E. Thompson, president of the Pan-American Railroad and who recently resigned as American Ambassador to Mexico, has been granted a concession to utilize the water of the Tonala River at a point near the town of Tonala, State of Chiapas, for generating electric power, and to furnish the town of Tonala with electric lights. The shops and general offices of the Pan-American road will be removed to Tonala.

A hydroelectric plant is being installed in the western part of the State of Chihuahua by the Lluvia de Oro Gold Mining Company. It will be of 400 hp.

The construction of the electric railway that is to be built between Guadalajara and the pleasure resorts on Lake Chapala by the Compania Hydroelectrica e Irrigador de Chapala, of Guadalajara, will be started as soon as the survey which is now in the hands of the Government department of fomento is formally approved. This proposed road will be about 35 miles long. The company is also making good progress on its proposition to build an electric railway between Guadalajara and the city of Aguascalientes.

That Texas is an inviting field for the building of interurban electric lines is shown by the large number of projects of this character that are now on foot in different parts of the State. Most of these proposed new lines have for their territory the thickly populated sections around Dallas and Fort Worth. The plans for building an interurban electric line between Fort Worth and Mineral Wells, a distance of about 50 miles, are being matured. The syndicate that is promoting this project is composed of Mike Hurley, J. S. Hansford and Paul Hurley. The proposition is indorsed by the Board of Trade of Fort Worth and an effort is now being made to secure subscriptions to the amount of $125,000 to the capital stock of the company among the citizens of the town. It is stated that no stock subscriptions will be collected until after the road is finished. The survey for the proposed line has been made.

An international interurban electric railway is to be built to connect the city of Brownsville, Tex., with Matamoros, Mexico. The new bridge that is now being erected across the Rio Grande will be used to connect the two towns. The project is being promoted by B. G. Stegman, of Brownsville, and associates. They have applied to the City Council of Brownsville for a franchise to use the principal streets for the local railway system and to build a line to West Brownsville.

Edison Storage-Battery Patents.

A process for impregnating the mass of material for alkaline storage batteries with an oxygen compound of bismuth is well described in a patent issued on Jan. 18 to Mr. Thomas A. Edison. The process is designed for use commercially in connection with the manufacture of the depolarizing material before the latter is introduced within the receiving pockets.

In carrying out the process nickel hydroxide is first crushed into small granules so that the whole mass will pass a 20-mesh screen. To this material is added a concentrated solution of trichlorid of bismuth dissolved in a strong aqueous solution of chloride of ammonia. Enough of this solution is added to cover the nickel hydroxid mass, which is allowed to soak for several hours in the solution until the pores of the hydroxid particles become saturated therewith.

The solution is now drawn off, and the wet mass of active material is preferably subjected to the action of a centrifuge, by which most of the adhering solution will be removed and a rapid partial drying thereby effected. The mass is now dried either naturally or by the application of heat, and when thoroughly dry, is added to a considerable excess of a 10 per cent solution of potassic or sodium hydrate, which is then heated for several hours near the boiling point, and for about 30 minutes at the boiling point. As a result of this action the bismuth salt will be converted to the oxid or hydroxid thereof. Afterward the caustic solution is drawn off and the resulting mass is successively washed with warm water until the alkali is washed out, after which the mass is dried and is ready to be used in connection with the make-up of the electrodes in any suitable way.

It is claimed that storage batteries employing nickel hydroxid, the particles of which contain in their pores, bismuth oxid or hydroxid, as explained, will not deteriorate in capacity to the same extent over long periods of time, as when nickel hydroxid alone is used. By employing in the electrolyte a small percentage of lithium hydroxid the capacity of the battery is very greatly increased, especially when used in badly ventilated places in which the temperature of the cells is unduly raised. The inventor remarks that he is unable to explain the reason for the superior results which are secured when bismuth oxid or hydroxid is employed in connection with the active nickel mass and when lithium hydroxid is used in the electrolyte, but the fact remains that, as a result of actual test and observation, the advantages pointed out are secured.

Monopoly, Competition and Standardization.

At the Boston dinner of the American Engineering Societies on Jan. 21, a report of which is printed elsewhere, Mr. George Westinghouse, president of the American Society of Mechanical Engineers, delivered an address on the subject, "Monopoly, Competition and Standardization," which is printed below in full.

I feel most highly honored to-night by being permitted to attend this gathering of the representatives of our great engineering societies, and particularly so that my recent election to the presidency of the American Society of Mechanical Engineers has been made an occasion enabling me to meet, under these pleasant circumstances, such a distinguished and representative body of men, whose work, individually and in association with others, counts for so much in the remarkable developments of this great era of engineering achievements.

The wonderful material advances in all directions in our country which we have been participating in or witnessing are largely the results of the skill and activities of engineers, who, realizing the value of co-operation, have, to still further add to their power and influence, associated themselves in organizations or societies representing many branches of engineering, civil, mechanical, electrical, mining, chemical, architectural, nautical and others; a member of one society often being deeply interested in the details of one or more other societies. In fact, the interrelations in engineering matters are such that it is no longer possible to draw even an approximate line of demarcation between them.

It, therefore, seems most fitting and logical that we should encourage closer and more intimate relations between all engineering societies in order that we may benefit from the power and influence which may come from combined efforts, not only for the advancement of science, but for the general welfare of every inhabitant of our country; and by working on broad, generous lines cause individual and professional prejudice with narrowness of vision to give way to that healthful condition of mind so necessary to correct conceptions and actions.

For many years, and particularly in recent ones, the tendencies have been, and are now, strongly toward large and powerful railway and industrial combinations and their constant skilful development, the very magnitude of which, with the evil practices so frequently disclosed in the press and in our law courts, have so aroused the public that there is now a fixed determination to establish by national and State laws an exacting Governmental control of practically all forms of corporations in order that competition may be encouraged and not stifled, but seemingly without due regard to the real objects in view, viz., the securing of the best public services in all forms; the best foods and goods for our daily needs; the greatest possible comfort to the masses, and as great freedom as possible from those restrictions which hinder rather than promote honest endeavors.

Many of the hardships which will arise in the daily conduct of our affairs as the result of existing and proposed legislation might have been avoided by those responsible for the creation of great combinations had they appreciated the inevitable consequences of their selfish and unwise course in their efforts to gain a monopoly by suppressing competition by methods so transparently wrong that those efforts have been met by the strongest possible demand for controlling legislation.

I have said the tendencies have of late years been toward large combinations, but fortunately there are indications, of which this gathering is one of many, that the great leaders in our affairs (as witness the meetings now being held in Washington of Governors of numerous States) are alive to the importance of the regulation of legislation and the creation of sentiments which will bring business men to their senses.

The engineering societies, by like joint action, have it in their power to do much to better conditions. Probably there is no better way for them to do so than to show, from their knowledge and experience, that unregulated competition and rivalry in business have established conditions which have made our costs greater and render ideal conditions in industrial engineering matters most difficult of realization.

To make this clear I need only call your attention to the effects of this unregulated competition in one great industry—the electrical—which has grown up in less than 25 years. No user of electrical apparatus can fail to appreciate the advantage it would be to him when some repair part is needed if certain standards were followed by all constructors with reference to equivalent devices; but it is lamentable to say that with the single exception of uniform bases for incandescent lamps, there are now practically no standards.

No other development has been comparable with the electrical, and never were there so many active minds at work on further developments as at the present moment. Each inventor sees what he believes to be a chief thing to attain. The vast majority of our inventors, however, having had but little experience in mechanics and mechanical engineering, usually proceed along independent lines, with the result of a constantly growing confusion, to the disadvantage of everybody.

To further illustrate the points I have tried to bring to your attention I quote as follows from a letter to me on this subject:

"To illustrate the growth in the number of motor ratings required now as compared to the earlier days when 60 ratings sufficed, a summary is given of the motors manufactured by the company with which I am connected. These figures refer to stationary motors only in sizes up to 200 hp. All of these motors are regularly manufactured and no special motors are included.

"For direct current, 55 frames are used giving 1600 ratings. For alternating current, 80 frames are used giving 1950 ratings. Or a total of 135 frames are used giving 3550 ratings.

"Practically any one of these may be furnished in three types: (a) shaft horizontal; (b) shaft vertical; (c) with countershaft bracket and bearings mounted on the frame. This makes a total of three times 3550, or something over 10,000 different motors available. In spite of this, there is a constant and increasing demand for special motors. In the past year approximately 10,000 estimates have been made on special motors under 200 hp, even though the greatest effort has been made to divert all inquiries to our regular lines of motors.

"Many of these special estimates were necessary because the prospective customer wanted to buy a motor having the same characteristics as a motor offered by some other manufacturer. Our standard motor may have differed in any one of the following characteristics:

"(a) Horse-power or speed rating; (b) dimensions of base; (c) over-all dimensions; (d) height from base to center of shaft; (e) weight; (f) method of lubrication; (g) size of shaft; (h) performance guarantees.

"This demand for special apparatus places a heavy burden on the manufacturer. The purchaser also suffers because of increased cost and long deliveries.

"Consideration of the above and a general review of the situation leads to the conclusion that the benefits that will result from standardization will more than compensate for the work and expense required in making the necessary changes."

While these quoted particulars relate to only a part of the motors made by one large company, it must not be forgotten that there are half a hundred others manufacturing equivalent lines of motors and that each maker has his own patterns and designs, so it is safe to say there are 50 or more thousands of needless variations in motors which have added many millions of dollars to the investment already made in installations of electrical machinery.

I have long believed, and have urged upon my associates for the 14 years during which the two large electric companies have had the joint use by a license agreement of several thousands of patents relating to their business, that by co-operation in the development of apparatus and by the use of the same designs and by the exchange of engineering and manufacturing particulars, there would be evolved the very best of all kinds of electrical machinery and details, and that the products of the two

companies could be made interchangeable, not only to the advantage of the purchasers and users of electrical apparatus, but also to the advantage of the companies themselves. Other views have prevailed, however, and there has existed an unregulated competition which has made the electrical industry about the poorest of all in the matter of profits.

There are many here who know the consequences of the adoption of different gages for railways, the final result being a change, at enormous expense, to those railways having had the disadvantage of adopting a standard which differed from that of their more powerful neighbors. Unless there be some action in the near future by those who have the gift of foresight, we will soon have a like difficult condition to meet due to the establishing of widely different systems for the electrification of our main railways. It seems certain that in the near future a system should be selected which would be capable of universal use, so that an electric locomotive or car of one railway could operate upon all other lines. Obviously, the selection of such a system should be removed largely from the domain of commercial competition.

Those engineers who have studied the problem of the electrification of our railways cannot have failed to realize that it is not only a question of the development and selection of the right system, but that the financial questions involved are such that the speedy realization of the complete electrification of the railways, either of the entire country or of even populous sections, cannot be forthwith carried out; in other words, there must be given full consideration to those who have the management of our railways in the difficult problems before them, not the least among which being the raising of the capital required to carry out what will be really stupendous operations.

By a combined effort of all of the engineering societies with the financial support of all manufacturers, who would be largely benefited and who could well afford to pay in pro rata amounts the expense of a well-equipped and officered bureau of standardization, it seems to me such a bureau could be established and could work a reform of incalculable value in our present practice and thus forestall Governmental activity in the same direction.

The public needs no further incitement to the regulation of such matters by the Government. What is needed is such wise co-operation on the part of the large interests involved and such fair consideration of the public rights as may stay further Governmental action and finally render it unnecessary.

The field which I have suggested for the useful co-operation of all classes of engineers is altogether too large to be covered by cursory discussions, but it is one worthy of your serious consideration, and I shall feel that something has been accomplished if my remarks to-night have interested you even slightly.

Indirect Lighting Discussed at Chicago.

The Chicago Section of the Illuminating Engineering Society held a meeting during the Electrical Show at the Coliseum the evening of Jan. 20. Dinner was served at 6 p. m. and a discussion of indirect lighting took place immediately after dinner. Chairman Albert Scheible first called upon Mr. Frederick J. Pearson, electrical engineer of Marshall Field & Company, to discuss indirect lighting from the standpoint of cleaning or maintenance. Mr. Pearson first called attention to the great differences in the surrounding conditions which affect the cost of cleaning and the necessity for frequent cleaning. Obviously, more cleaning is required in a planing mill or factory than in a store, library or church.

In a library indirect lighting installation with which he is familiar the cost for cleaning is $0.0027 per kw-hour. In a residence which has indirect lighting throughout, it requires about four hours per month of a servant's time or one hour per week to clean the lamps and reflectors. The cost is estimated at $0.005 per kw-hour. He had made an estimate on the probable cost of cleaning in a large mercantile institution using 3,000,000 kw-hours per year on the hypothesis that six men would be required at $1.50 per day. In this case the cost would be $0.001 per kw-hour. He did not include the cost of cleaning or refinishing ceilings in the foregoing, because that is done twice a year in any event in such an establishment.

Dr. Henry Gradle, one of the leading oculists of Chicago, discussed the matter from his standpoint. He said that indirect lighting appeals most to the oculist because of its resemblance to daylight. By day we get illumination from large, uniformly lighted areas of the sky. With direct artificial lighting we get illumination from small, intense sources. As the eye has been developed for centuries under daylight and it is only recently that artificial lighting has come into use, it is fair to assume that in general the human eye will be least imposed upon in daylight. A large number of eyes are not normal. Such abnormal eyes may be inflamed or irritated, or may be of improper "mechanical construction." Furthermore, some people with normal eyes are especially susceptible to eye-strain because of the state of their nerves. Nearly all people with abnormal eyes state that they are more comfortable by daylight than by artificial light. People with strong, normal eyes may not notice the difference. In this discussion, he assumed that in each case the intensity of illumination would be sufficient, both with direct and indirect lighting, so that no eye-strain would exist because of insufficient intensity on the work. He pointed out how the eye is sometimes slow in adapting itself to changes in illumination. With waning daylight and a given amount of artificial illumination, it is frequently the case that more artificial illumination is wanted than after darkness has set in. A light in the field of vision casts a kind of physiological shadow over objects in its vicinity. If we go out with a lantern on a dark night, we instinctively place it out of our field of vision at one side, in order to avoid the apparent shadow which it casts a short distance ahead. Now the presence of exposed lights in a room would not make much difference if one were always looking at a single sheet of paper. However, this is never the case. One instinctively looks around the room to rest the eye. In general, all who have abnormal eyes appreciate especially indirect illumination.

Mr. George Harvey Jones was called upon to give his experience with indirect lighting. Mr. Jones noted that we are coming more and more to want the entire room illuminated, rather than to illuminate certain parts of it. In some cases he thought this might be carried too far. He had used indirect lighting in his home for over a year. He had come to the conclusion that the ideal system is indirect lighting for general illumination, supplemented by well-shaded table or bracket lamps for local illumination and artistic effect. A room lighted entirely by indirect lighting will throw unpleasant shadows around the eyes if the walls are dark. In his own living-room he uses 0.5 watt per square foot for indirect lighting, supplemented with a table lamp. In his office indirect lighting taking 1 watt per square foot had been installed. The illumination seemed ample; in fact, almost too great. A stand lamp has been added for direct lighting for each man and the results are more satisfactory. He noted that an amount of artificial lighting which is sufficient at night is inadequate in twilight. He believes that too high intensity of indirect lighting is tiresome.

Mr. J. R. Cravath gave a summary of tests made by various authorities the past four years on different indirect lighting systems. These showed strikingly the difference in efficiency between a properly designed, modern system of indirect lighting and one in which no particular thought was given to efficiency. Some of the indirect lighting installations tested took with carbon-filament lamps 10 times the watts per lumen required by a modern system in which tungsten lamps are used and light is obtained from central areas of the ceiling. Reduced to a tungsten lamp basis, the tests showed watts per lumen ranging from 1.68 to 0.325. Indirect lighting had proved remarkably popular. One would naturally suppose that it would be slow of introduction, but such had not been the case the past year. With indirect lighting diffusion must not be unnaturally perfect so as to eliminate all shadows. The

combination of direct and indirect lighting mentioned by Mr. Jones was excellent for some cases and was much better than a plain direct lighting system. However, the difficulties of glare from paper and other work must not be overlooked and these are generally less with indirect lighting than with a combined system. In offices where there is a mixture of daylight and artificial light, it is often advisable to provide at least double the amount of artificial illumination for these mixed illumination periods that would be needed for use at night.

Mr. A. L. Eustice gave the results of a number of tests he had made on indirect lighting on the system now most common, using tungsten lamps with inverted mirror reflectors throwing the light first to the ceiling. These covered a number of different conditions and gave net results all the way from 0.408 watt to 0.835 watt per lumen. In one test after a few weeks' use with the system dirty, the result obtained was 0.807, and, after cleaning, 0.667. In another case the result was 0.757 after the system had been in use three weeks and was dirty, and 0.408 with the system clean.

Prof. L. B. Spinney questioned the point made by Dr. Gradle that we have diffused lighting in nature. When the sun is shining we have very strong direct lighting with decided shadows.

Wisconsin Electrical Association Convention.

The first annual meeting of the Wisconsin Electrical Association was held at the Hotel Pfister, Milwaukee, Wednesday and Thursday, Jan. 19 and 20, 1910. This association is the recent consolidation of the old Northwestern Electrical Association and the Wisconsin Electric & Interurban Railway Association. The attendance was excellent, nearly 70 operating central-station men being present, representing over 50 companies. All sessions were called to order promptly at the hour specified on the program, which is a pleasing innovation in convention programs.

The first session was called to order by President Ernest Gonzenbach, of Sheboygan, at 10 a. m., Jan. 19. A brief recess was held for the purposes of registration and securing of badges. Secretary John S. Allen read the minutes of the last meeting of the two associations, at which the consolidation took place, which was held at Waupaca June 28 and 29, 1909. These minutes contained the conditions of consolidation and the classification of membership of the new association. Class A members are composed exclusively of companies engaged in the manufacture of electricity, whether for lighting, power or railway purposes. No individual can be a Class A member. Each company is entitled to send as many representatives to a convention as it chooses, but only one is entitled to vote.. The dues for Class A members are settled by delegates in executive session and vary according to the income of the company. Class B membership consists of individuals who are engaged in the electrical business or in the sale of electrical appliances. They are entitled to all the rights and privileges of the association except that of voting. Their dues are $5 per annum. The minutes having been approved, it was voted to appoint a committee to audit the accounts of the secretary and treasurer. This committee appointed consisted of Messrs. T. A. Pamperin, of Oconoto; H. A. Miles, of Durand, and H. G. D. Nutting, of Fort Atkinson.

The report of Mr. John S. Allen, as secretary and treasurer, was then read. He noted that the most important move of the year was the consolidation of the two associations at the Waupaca meeting, which seemed imperative.

The members then listened to the address of President Gonzenbach. He touched on the deplorable condition of the Northwestern Electrical Association, of which he had been elected president a year ago. When the present officers took hold they found the association badly in debt and no records obtainable. The association had done good work and had in its ranks broad-minded members and earnest workers. Past accomplishments would keep its memory green, but recently the records were found to be in such condition that the officers could not even tell who were its members. The junior member of the new consolidated association, the Wisconsin Electric and Interurban Railway Association, was very vigorous. He then reviewed the Waupaca meeting proceedings which resulted in the consolidation of the two associations. The new association has an enormous amount of work ahead of it. The operating problems are the small details—the infantry of the campaign, and, like the infantry, rightly receive the best care and attention. No man engaged in the electric railway or lighting business is too big or too little to come to these meetings and profit by them.

There are matters which are purely financial that have not in the past received the attention they deserve. He did not recollect having heard a discussion at previous meetings on such questions as fire, accident and liability insurance. Neither would it be out of place to discuss ways and means of raising the standard of electric lighting and railway securities in the eyes of the investing public. Plans for marketing securities so as to save the middleman's commission are entirely within the range of these sessions.

Mr. Gonzenbach intimated strongly that the companies of the State have expressed too much admiration for the railroad commission. As a matter of fact, the companies were like the small boy who brings presents to the schoolmaster in the hope of averting the wrath to come, but at the same time comes to school with newspapers stuffed in his pants. The public has heard the praise of the commission by officers of public-service companies, but has not seen the wads of paper stuffed in their pants. He had no quarrel with the commission, and did not agree with those who thought the commission was the ruination of the public-service business in Wisconsin. Wisconsin has a commission which, in personnel and organization, is superior to any other commission in the United States. He thinks that the law gives the commission an undue and unjust jurisdiction over affairs which are fundamentally beyond the right of any commission to inquire into.

In the large cities during the mornings and evenings hundreds are hanging on straps in the cars; not because of any unwillingness to supply cars, but because the money which should be used for rolling stock and better service has gone for the paving which the company does not wear out or use, and for a thousand and one other requirements of municipal councils, city administrations and State Legislatures. A politician never hurts corporation or business interests if he honestly and sincerely endeavors to use his power for the public good and the greatest good to the most people. It is the ward heelers and hangers-on that are most troublesome. The Railroad Commission was created to stand as a bulwark between abuse of power by corporations and political hyenas of that stamp.

In regard to association administration, Mr. Gonzenbach advocates the plan used by the American Street and Interurban Railway Association of advancing officers step by step through the various vice-presidencies so that only the lowest vice-president is elected each year. This plan insures the president's office being filled by a man thoroughly acquainted with the policy and work of the association. He complimented Mr. John S. Allen on his work as secretary, and recommended earnestly the re-establishment of a salary for the secretary and electing someone who can be permanently endowed with the duties of that office. The secretaries' salaries have not been accepted by the incumbents of the office for the past few years, which has established a bad precedent, although fortunate for the association's treasury. The best interests of the association would be preserved by selecting the best man for the office and paying him an adequate salary commensurate with the service.

On motion of Mr. Lord, of Waupaca, it was voted that the chair appoint a nominating committee to consist of non-officers. The chair appointed this nominating committee later. It consisted of Messrs. Dudley Montgomery, of Madison; B. D. Viles, of Chippewa Falls, and W. R. Putnam, of Marinette.

Mr. W. R. McGovern, of the Wisconsin Telephone Company, presented a paper on "Inventories," which discussed the methods of estimating present value and cost of replacement of existing telephone plants. The principles given applied also to elec-

tric light and railway properties. This paper was discussed at length by Messrs. C. N. Duffy, comptroller of the Milwaukee Electric Railway & Light Company; Harold Almert, of H. M. Byllesby & Company, Chicago, and others.

In the course of this discussion Mr. Duffy, commenting on the president's address, said that while commission hearings brought on by complaints made to the commission had cost his company a fortune to defend, nevertheless he thought that the commission had done more than anything else to improve the standing of electrical securities in Wisconsin. The discussion on Mr. McGovern's paper was continued over into the afternoon session, which was begun promptly at 2:30. Mr. Duffy spoke especially on the subject of depreciation, which drew out a number of questions and afforded those present much interesting information.

Mr. O. M. Rau, electrical superintendent of the Milwaukee Electric Railway & Light Company, presented a paper on "Electric Automobiles." This was discussed by Mr. T. C. Martin, executive secretary of the National Electric Light Association, who was in attendance at the convention, and who has made an extended investigation of the electric vehicle situation with relation to the central-station industry.

Mr. W. R. Putnam, superintendent of the Menominee-Marinette Light & Traction Company, read a paper on "Handling Complaints and Enforcing Discount Dates," which drew out a long discussion, participated in by Messrs. Harold Almert, of Chicago; W. H. Winslow, of Superior; H. A. Miles, of Durand; George B. Wheeler, of Eau Claire; F. W. Downs, of Washburn; T. A. Pamperin, of Oconto; M. C. Ewing, of Wausau; P. H. Korst, of Janesville, and others.

Mr. J. P. Pulliam, superintendent of the railway department of the Wisconsin Electric Railway Company, read a paper on "Electric Railway Fares," giving some of the experiences of his company in increasing fares which were originally too low.

The secretary announced the receipt of a telegram from Mr. H. E. Niesz, manager of the Chicago electrical show, inviting the association to be the guests of the show on Friday.

The Thursday morning session opened with the report of the auditing committee on the treasurer's accounts, which was accepted.

Mr. W. B. Voth, general superintendent of the Sheboygan Light, Power & Railway Company, read a paper on cooking and heating by electricity, which was the result of considerable personal investigation on his part of the expense of electric cooking and the feasibility of the apparatus. This paper was discussed by Messrs. J. R. Cravath, of Chicago; P. H. Korst, of Janesville; L. L. Tessier, of Depere; Harold Almert, of Chicago; H. C. Stirling, of New London, and others. Mr. Stirling showed an oven on the fireless-cooker principle which he had built and is experimenting with. Mr. H. G. D. Nutting, of Fort Atkinson, told of a fireless cooker with which he is experimenting, in which fusible plugs are used to cut off current and prevent overheating if the other devices do not work.

Mr. T. C. Martin was introduced for the purpose of addressing the convention on the subject of the National Electric Light Association and its work. He first congratulated the association on its reorganization and on its prosperous condition, as evidenced by the excellent convention being held. In regard to the discussion just held on electric heating devices, he recalled in 1886 having read the first paper presented before the National Electric Light Association on "The Electric Motor." At that time the managers present expressed many of the doubts regarding the electric motor that the managers to-day expressed about electric heating appliances. Objections were raised as to the prices demanded by the manufacturers, the practicability of motors, the necessity for low rates, and so on. As all know, the motor-service business is to-day one of the most important elements in a central-station load.

He said that the next convention of the National Electric Light Association will in all probability be held at St. Louis. The association has undergone a remarkable growth in membership during the past three months. Mr. Martin gave the credit for this result to Mr. H. H. Scott, chairman of the membership committee, who is a Wisconsin man. The increase in membership mentioned is 1200, of which about 60 are Class A operating companies. Last year the three volumes of the N. E. L. A. proceedings aggregated 2700 pages. The monthly bulletin of the association last month contained 44 pages, of which 27 pages were devoted to the Question Box, which is conducted mainly to answer the questions of small companies. The first edition of the "Electrical Solicitors' Handbook," consisting of 2500 copies, had been exhausted, and in a period of seven months 5000 copies of this book have been demanded. It is now being revised for another edition by the leading men in the various branches. The association maintains an insurance expert at a large retainer fee for the benefit of its members.

The association is getting ready to publish information regarding rates for the benefit of members which are asking for new franchises. Ordinances on electric signs are being compiled. The association has on its standing committees 150 of the leading central-station men in the country. A manual on central-station accounting is soon to be published, which will help to standardize central-station accounting methods and simplify the situation when new State commissions are created. The National Electric Light Association is fast coming to a Federal basis. The constitution provides for State or geographical sections. Pennsylvania, New England and Vermont associations have already become such sections.

President Gonzenbach, commenting on Mr. Martin's remarks regarding geographical sections, said that the matter of affiliation with the N. E. L. A. must soon be considered by the Wisconsin association. One difficulty was that the Wisconsin association includes railway and lighting companies. On motion of Mr. Harold Almert, it was voted to appoint a committee to consider plans for affiliation with the N. E. L. A. The chair appointed as such a committee Messrs. P. H. Korst, Janesville; W. R. Putnam, of Marinette, and L. L. Tessier, of Depere.

A paper was on the program on "Wheel and Axle Maintenance," but as the author could not be present, a general discussion was held on this subject. The discussion was introduced by President Gonzenbach. Mr. W. E. Olds, superintendent of rolling stock of the Milwaukee Electric Railway & Light Company, gave a brief history of the standardization of equipment and cited figures on the life of wheels and axles on the Milwaukee system. Mr. W. H. Evans, assistant superintendent of rolling stock for the Milwaukee Electric Railway & Light Company, also took part in the discussion. Mr. Olds outlined a valuable method of detecting cracks in axles near the wheel fit, and also discussed unnecessary car weights.

Profit-sharing with the public in connection with public-service enterprises was taken up in an executive session on Thursday afternoon. Mr. W. H. Winslow, secretary and general manager of the Superior Water, Light & Power Company, led this discussion. Mr. Winslow, as announced by him at the 1909 convention, has been figuring out a plan for profit-sharing in connection with his company's franchises. This discussion was for the purpose of getting views of officers of the various other companies in the State as to the ideas proposed.

INDETERMINATE PERMITS.

The open session held on Thursday afternoon was devoted to a discussion of "Indeterminate Permits." Under the public-utility law of Wisconsin, a company may give up its franchise and accept in its place an indeterminate permit. The desirability of such indeterminate permits has been a matter of much speculation among Wisconsin companies. One member reported having surrendered its franchise upon advice of its attorneys, in the belief that the acceptance of the indeterminate permit was advantageous. In accepting such a permit the company places itself in the hands of the public-service commission and no competition in its territory is permitted as long as the company is properly serving the public. The question was raised whether

the Supreme Court might not declare, in a contested case, that the indeterminate permit is unconstitutional. It seemed to be a general opinion that in such an event the company would have to be given its old franchise terms.

Mr. George B. Wheeler, of Eau Claire, stated several reasons why it is good policy to accept the indeterminate permit. The company shows its good faith and willingness to depend on its good behavior. He thought that the State would never repeal the public-utilities act and withdraw the indeterminate permit feature.

Mr. E. R. Bowler, an attorney of Sheboygan, Wis., thought that no company would lose by accepting such a permit. The indeterminate permit largely eliminates local politics and the dangers connected therewith.

Mr. Clement C. Smith, president of a number of operating companies, expressed some doubts as to the valuations which would be placed upon properties operating under indeterminate permits, and whether they would be permitted to earn a fair rate on the total value, including franchise value.

Mr. C. N. Duffy in this connection recalled that in the Milwaukee 3-cent fare case a Milwaukee city attorney held that the building up of an amortization or depreciation reserve should not be charged against the cost of service. Nevertheless, the Wisconsin Railroad Commission classification of accounts includes such an account. Mr. Winslow, of Superior, cited the statement in the public-utility law to the effect that in the event of municipal purchase of a property operating under an indeterminate permit the company shall receive just compensation. According to a decision of the United States Supreme Court just compensation has a definite legal meaning, which is that it includes all existing elements of value. Mr. Wheeler said that the law is a step toward State regulation as a substitute for municipal ownership. It is a wise law for both the communities and the companies. It stops needless competition and in its stead regulation is now being tried.

OFFICERS ELECTED.

The officers elected for the ensuing year, as recommended by the nominating committee, were as follows: President, Clement C. Smith, of Milwaukee; first vice-president, George B. Wheeler, of Eau Claire; second vice-president, Irving P. Lord, of Waupaca; third vice-president, W. H. Winslow, of Superior; secretary and treasurer, John S. Allen, of Lake Geneva.

COMPLIMENTARY SMOKER.

On the evening of Jan. 19 a complimentary smoker was tendered to the delegates by the various manufacturing supply companies represented. This was arranged for by an exhibitors' entertainment committee consisting of Messrs. H. P. Andrae, of Julius Andrae & Sons Company, of Milwaukee; W. R. Pinckard, of the Westinghouse Electric & Manufacturing Company, Chicago, and F. G. Bolles, of the Allis-Chalmers Company, Milwaukee. The opening address was given by Mr. C. N. Duffy, comptroller of the Milwaukee Electric Railway & Light Company. The master of ceremonies was Mr. F. G. Bolles. The program consisted chiefly of music and story telling. A program of popular songs was provided, which were taken part in by all present. Mr. Will Hunter, impersonator of Harry Lauder, gave a number of selections, and a minstrel trio led the choruses.

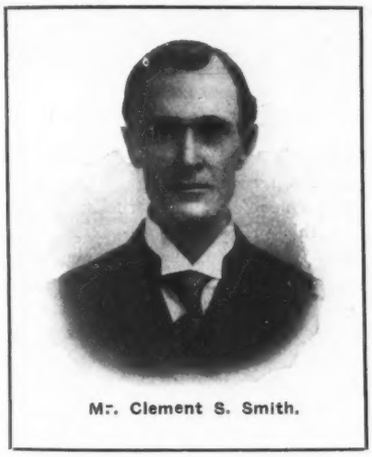
ANNUAL BANQUET.

The annual banquet was held at Hotel Pfister on the evening of Jan. 20. Mr. C. N. Duffy acted as toastmaster. The chief speaker of the evening was Prof. Shailer Matthews, of the University of Chicago, editor of the *World To-day*. Before his address several members were called upon by the toastmaster. Mr. Harold Almert, of H. M. Byllesby & Company, Chicago, urged the attention of small companies to accurate records and a recognition of depreciation so that they may know the difference between apparent profits and actual profits. Mr. George B. Wheeler outlined the reasons behind the organization. Mr. T. Commerford Martin spoke of the growth of the electrical industry and the evidences of its substantial character. Mr. John I. Beggs warned the operators of the smaller companies as to the dangers of some of the existing low rates if the stockholders are to be assured continuous returns on their investment. He held it the duty of the administrator of each property to give the public the best available service practicable.

Prof. Matthews had for his subject the "Remaking of Public Opinion." Public opinion is a most powerful element in all undertakings. It is responsible for all important actions. At the present time public opinion is going through a most remarkable change. It is a dynamic rather than a static force. Each member of a community should take his part in the process of remaking public opinion so that from it good for the community will ensue. The press, the theater, the school and the pulpit were named as the chief molders of public opinion. The management of a corporation owes it to its stockholders and to the public to see that its local press does not misrepresent actual conditions.

THE NEW PRESIDENT.

Mr. Clement C. Smith, the president-elect of the Wisconsin Electrical Association, is president of a number of public-service companies in Wisconsin and elsewhere. Among these are the Eastern Wisconsin Railway & Light Company, of Fond du Lac, operating the electric light plant, gas plant, city railway line and interurban line to Oshkosh; the Wisconsin Electric Railway Company, of Oshkosh, operating the city system of Oshkosh



Mr. Clement S. Smith.

and the interurban lines to Neenah and Omro; and the Citizens' Gas Company, of Kankakee, Ill. He is vice-president of the Lee County Lighting Company, owning the electric light plant, gas plant and water-power at Dixon, Ill.; vice-president of the Sterling, Dixon & Eastern Railway Company; president of the Columbia Construction Company, of Milwaukee, and vice-president of the Fidelity Trust Company, of Milwaukee. He was born in Cleveland, Ohio, and is 43 years old. He was assistant engineer of construction of the Great Northern Railroad in 1887. In 1890 he became assistant engineer of the Minneapolis Street Railway Company. In 1891 he was assistant chief engineer of the Milwaukee Street Railway Company in charge of construction. In 1893 he was chief engineer in charge of construction of the La Crosse City Railway Company. In 1894 he was chief engineer of the Milwaukee Street Railway Company. From 1895 to 1896 he was chief engineer of the Chicago City Railway Company. For the following five years he was with the Falk Company, of Milwaukee, first as general superintendent and later as first vice-president. In 1901 he organized and became president of the Columbia Construction Company for the purpose of constructing and operating electric railways and electric and gas properties. He was one of the charter members and first secretary and treasurer of the Wisconsin Electric and Interurban Railway Association, which was organized in 1907. He was president of that association previous to the consolidation which formed the Wisconsin Electrical Association.

Edison-Beach Electric Railway Car.

In the issue of Jan. 20 was published the first authoritative description of the new Edison storage battery. Following close on the heels of the announcement of the finished cell comes its application to street-railway work, a field in which the battery is expected to show excellent results. On Jan. 20 the first railway car equipped with Edison batteries was given a test on the tracks of the Public Service Corporation of New Jersey at West Orange, N. J., and the results of the test are said to have been highly gratifying to the inventor and to Mr. Ralph H. Beach, the designer of the car.

Observation in the traction field showed that the power consumption of electric automobiles per ton-mile was very much less than the power consumption of standard railway cars, and

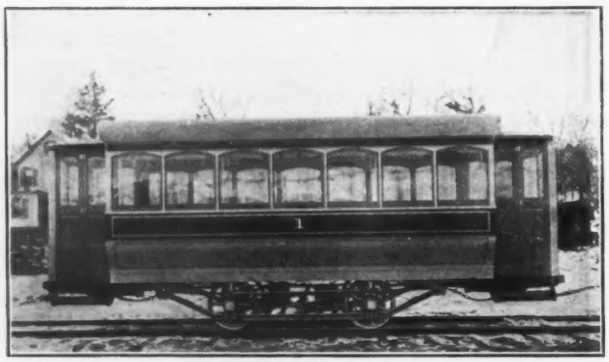


Fig. 1—Side View of Car.

in order to obtain results comparable to those of an electric automobile, the Edison Storage Battery Company, of Orange, N. J., undertook to develop a car, truck and electrical equipment suitable for this special purpose. This necessitated some marked departures from standard practice, but resulted in a car body, truck and driving equipment very much lighter in weight than that ordinarily used.

Fig. 1 shows an exterior view of the car, and, inasmuch as it differs entirely from standard practice, the details are of interest. The body of the car is 18 ft. long between posts, with 4-ft. vestibule platforms. The width at the sills is 6 ft. 6 in., and the width at the drip rails 7 ft. 3 in. The seating capacity of the car is 26. The underframe of the car is made up of two 3-in. x 6-in. ash longitudinal sills, and nine cross-sills of the same size and material. A steel tie rod runs by the side of each cross-sill and passes through the longitudinal sills, thus firmly binding the under structure. Two eccentric arches, each made of a sheet of three-ply veneer, form the roof, and are held in place by seven carlines conforming in outline to the two arches, and each of which is attached at the outer end to the vertical posts. The ends of the roof plating rest on the end bulkhead and the carlines being steel-plated, a light and strong roof results. The veneer has the usual canvas covering.

No side ventilation is provided in the car when the windows are closed, adjustable end windows performing this function. Under each seat, running the entire length of the body of the car, is a lattice steel electrically welded girder, which also forms a box for the batteries, a seat rest, a support for the side posts and a remarkably firm foundation for the entire structure. The girder is bolted to all cross-sills, side sills, end bulkhead, side posts, and by the interior grab rail serves also to support the roof. This lattice girder is the novel feature of the car body, and when the latter is loaded in the center with two tons, and supported on each end only, the deflection is hardly noticeable. The ordinary end doors are omitted in the car, but the vestibules are entirely enclosed. Hand rails of white enamel, two longitudinal and four vertical, are employed in place of straps, and the vertical rails also serve for holding the lamp fixtures and act as a conduit for the wires, besides supporting the roof, as previously noted. The interior of the roof is painted white, and the car is lighted by means of eight 10-cp, 12-volt tungsten lamps.

The battery equipment of the car consists of 200 cells of Edison A4 type for driving, and 10 cells of the same type for lighting. These cells are separately connected in working, but are connected in series when being charged, so that any variations in voltage owing to the operation of the car will not affect the lamps. The truck is of the standard-gage, four-wheel type, with 6 ft. 6 in. wheel base. The frame of the truck is of steel welded at all joints. The journal housings and all castings are of steel, and the bearings are of the ordinary railway type, except that they are ground and highly finished. Light steel wheels are mounted on 2½-in. diameter steel axles, each of which is divided in the center and provided with a steel sleeve to permit the free rotation of each wheel with respect to its mate. The sleeve preserves the correct alignment, and is said to result in a considerable saving, depending upon the conditions of road, wheels, etc. The designer of the car feels certain that this method of construction, which follows automobile practice, is advantageous where saving in energy is desired. Telescoping steel spring seats are provided between the truck and the body, which permit a side or end movement of not more than ⅛ in. The vertical movement is, of course, free. By this means the manufacturer expects to obtain a very smooth-riding body, since it cannot under any circumstances sway more than ⅛ in. The construction also permits closer work on the toggle-brake rigging than is possible with ordinary methods.

The driving equipment consists of two 5-hp, 110-volt Northern motors, which, besides possessing fairly high speed, are much lighter in construction than standard motors of the same output. The wheels are driven from these motors by means of a silent chain drive. During the trials it was found that the motors gave the car a maximum speed of 15 miles per hour, and with 14 stops per mile enabled a schedule of eight miles per hour to be maintained. The power consumption in accelerating is said to be about 3½ kw and in running about 1½ kw. The consumption is, of course, variable, and depends very much upon road

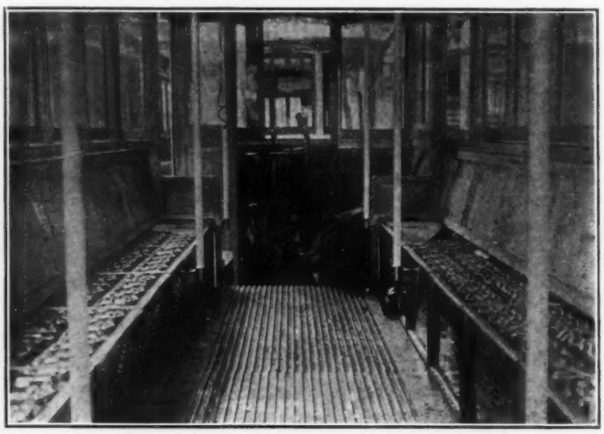


Fig. 2—Interior View of Car, Showing Batteries.

conditions. The controllers are arranged to give the following three combinations: First step, batteries in multiple at 50 volts and motors in series; second step, batteries in multiple at 100 volts and motors in series; third step, batteries at 100 volts and motors in multiple. During the tests the car accelerated quite smoothly. The body of the car weighs 3500 lb., the truck and electric equipment 3500 lb., and the battery 3000 lb., giving a complete car of 10,000 lb. In the design of the car many new features other than those mentioned are embodied, and while some minor changes have suggested themselves, the general make-up of succeeding cars will not differ essentially from that of the car described. The battery equipment is said to be capable of supplying energy for 150 miles on a single charge.

Maryland Public Utilities Bill.

An objection to the Public Utilities Bill that is awaiting the action of the Maryland Legislature was entered last week by one of the most prominent lawyers in the State, who made a statement from which the following is extracted:

"The suggestion of a public-utilities commission has not awakened popular enthusiasm in the State of Maryland. The Attorney-General has drafted an elaborate act and published an exhaustive pamphlet. The Governor gave a public hearing. The public unanimously stayed away. He then invited the corporations as being probably interested in the measure. Even these would not come, and Mr. Straus had to explain the bill to the Cabinet alone. All this may be because the people are in favor of it, but it looks more like one of those anti-election silences that in Maryland are always ominous for somebody. The proposed measure evades two provisions of our Constitution that are deeply rooted in popular approval—that which limits legislative sessions to once in two years, and that which forbids the creation of salaries greater than $3,000 per year. The proposed act establishes a new body far more expensive than a Legislature, that shall sit all of the time and create salaries of $8,000 and over by giving the officials a 'double aspect.' If the measure be within the letter of the Constitution, it is certainly a violation of its spirit. There can be little doubt as to what would happen to the project if submitted to the people. Great fear was entertained that the Baltimore city loans would not go through, and the Constitutional amendment to increase the judges' salaries was beaten at the polls. As the people will have no chance to pass on this measure directly, it may not be amiss to consider it a little from two points of view:

"First—Is it well to make this permanent addition to the expenses of our State and city administrations? Second—Is a public-utilities commission desirable at all in Maryland at this time?"

In treating of matter of expense, it is pointed out that the act itself was misleading as to the expense involved. He claims that the running expenses of the commission would be more than $92,200 every year. The statement also pointed out the disadvantage of the creation of too many offices and lastly showed what effect the usual political management would have on the commission. In discussing the second issue it was stated that the commission would act as a sort of partner in the financial management of the State; that the movement would bar progress by not only discouraging new enterprises, but if put into effect at this time would drive out certain capital that is at present essential to the growth of the State.

New York Public Service Commission News.

The Public Service Commission of the First District of New York was quite active last week in connection with rapid transit matters. In the first place, Mr. Theodore P. Shonts, president of the Interborough Rapid Transit Company, at the annual meeting of his company, asserted that it was ready to go extensively into the building of new subways, being backed by J. P. Morgan & Company, and that it had almost begged the Public Service Commission to grant it additional franchises. This statement called out a tart response from William R. Willcox, chairman of the commission, the burden of which was that the demands of the Interborough were unreasonable and that the commission would not grant franchises except upon its own terms. Following this were some conferences between Mr. Shonts and Mr. Willcox in which it was reported that the former had modified his demands.

As a sequence to this subway controversy, the Public Service Commission has ordered an investigation into the present operation of the subway. The commission will inquire as to whether an order should not be issued requiring the company to provide a seat for every passenger or to at least operate at all times the maximum number of trains and cars. The hearings into these matters will be conducted by Messrs. Willcox and Eustis and will begin Jan. 27.

The contract between the Interborough Rapid Transit Company and the city of New York for the lengthening of the subway platforms has been drawn by the Public Service Commission and sent to the Corporation Counsel for his approval. The company has already provided itself with the material necessary for the work and this is expected to begin within a week. It will probably require 10 months to complete the job.

The Public Service Commission has ordered the Interborough Rapid Transit Company to put signs at each end of every car showing the destination of the train and also to put signs inside the cars. In addition to this, the company is ordered to erect new and larger signs near the approaches to the stations.

At the hearing on the Third Avenue Railroad reorganization plan before the commission last week, Mr. Henry Floy, consulting engineer, testified that the reproduction value of the property was $46,499,805. Of this amount about $6,500,000 represents the real estate, leaving about $40,000,000 for the tangible property. From this amount Mr. Floy estimated that fully 25 per cent should be deducted for depreciation. This estimate did not consider the value of franchises or good will or the charges that would be necessary to promote a new company.

The receivers of the Metropolitan Street Railway Company have protested against the order of the Public Service Commission calling for better service on the surface lines on 116th Street. The company claims that it has not enough cars and to do what the commission requires would rob other lines.

At a meeting Jan. 24, the commission authorized the issue by the Kings County Electric Light & Power Company of $2,500,000 of 6 per cent debenture bonds. This was a portion of the $5,000,000 issue which was asked for. The proceeds of the bonds authorized are to be used for improvements and extensions. The remaining $2,500,000, the proceeds of which are to be used for refunding purposes, have not yet been authorized.

The legislative committee resumed its hearings last week in New York City to determine whether or not a law should be recommended putting the telephone and telegraph companies under control of the Public Service Commission. Mr. R. C. Clowry, president of the Western Union Telegraph Company, testified that his company would have no objection to a reasonable supervision. He also told how his company had sold out its telephone business years ago to the Bell interests and how it had recently been awarded a judgment for $5,000,000 on its old contract. He invited the members of the committee to go over the Western Union office and study the methods of operation At the same hearing the committee received a letter from Mr. J. M. E. O'Grady, a former member of the Assembly, in which it was stated that when the United States Independent Telephone Company was promoted a few years ago, W. J. Conners, of Buffalo, leader of the Democratic party, was given $2,000,000 of stock without any consideration being paid therefor.

At another hearing, Mr. Clarence H. Mackay, president of the Mackay Companies which owns the Postal Telegraph & Cable Companies, testified that his companies were direct competitors of the Western Union Telegraph Company and also of the telephone companies, and that any talk of a combination with these concerns was absurd. He read to the committee a history of the organization and development of the Postal Companies and declared that they had been instrumental in breaking up the monopoly in land lines that had been created by the Western Union.

The committee will hold another hearing in New York, Jan. 28, and then begin sessions in Buffalo.

The Public Service Commission, Second District, will this week give a further hearing on the application of the Oriskany Hydroelectric Company for authority to issue stock to the amount of $500,000 and to execute a trust deed for $2,500,000; and the joint petition of the People's Gas & Electric Company and the Citizens' Lighting Company, of Oswego, for the People's Company to acquire all the capital stock of the Citizens' Company, the merger of the Citizens' Company by the People's Company and the issuance of $150,000 of common capital stock.

Massachusetts Legislative News.

Transportation matters continue to predominate in the public-utility business under consideration by the Massachusetts Legislature of 1910, although a number of bills of interest to electric lighting and gas companies will shortly be in committee. In the near future the committee on metropolitan affairs will probably give a number of public hearings upon the transit projects discussed in the recent reports of the Massachusetts Railroad and Boston Transit Commissions, and probably active steps will be taken to provide for the preliminary engineering work on a new tunnel between the Park Street district of Boston and the South Station. Bills have been introduced providing for the acquisition by the New York, New Haven & Hartford Railroad Company of the Berkshire Street Railway Company, for the purpose of securing a broader development of the section of the State west of the Connecticut River than appears possible by other means. It is expected that over $2,000,000 will be spent for improvements and new construction if a law is passed permitting the New Haven to co-ordinate the Berkshire trolley system with its own. Public sentiment in the western portion of the State is strongly in favor of this development.

As a result of a bill introduced by Representative Henebery, of Worcester, presumably on behalf of Mayor Logan, of that city, a contest of considerable importance is anticipated between the street railway interests and the municipalities on the matter of limited franchises for freight and express service by trolley lines. The companies in general appear to prefer an indeterminate franchise to a limited one, feeling more secure in the former case under the supervision of the Railroad Commission than in the latter instance, where the continuance of policies and expenditures might be seriously threatened. The Henebery bill provides that limited franchises may be granted by municipalities for this class of service.

A bill has been introduced by former Representative Kiley to abolish the present Massachusetts Railroad, Gas and Electric Light Commissions, and Boston Transit Commission, and to create two public-service commissions in their place, one for the Boston district and the other for the State outside. Each commissioner would have a salary of $8,000 per annum. The passage of this bill would tend to undo a large part of the excellent work of the Massachusetts commissions, which for many years have been growing more and more expert in the administration of the specialized duties, and which have in each field of supervision accumulated decisions and data which are still unique in the sphere of public-utility regulation. Under present conditions each of these boards is constantly occupied with important and exclusive duties, and in view of the pressure upon the members of the different boards, the economical and efficient organization of their staffs, and the general satisfaction of both the public and the utility companies with their administration, it appears that the measure suggested would be clearly hostile to the best interests of the State.

A bill has been introduced to prohibit a charge for the use of gas or electric meters. A bill has been introduced to provide for uniform telephone rates within the city limits of Boston, and one to permit savings banks to invest in the bonds of certain electric lighting and gas companies, corresponding to the statute which permits investment in certain street-railway bonds.

Massachusetts Commission News.

The Massachusetts Highway Commission has submitted its annual report to the Legislature of 1910, covering the work of the board in the supervision of highway construction and maintenance and of telephone and telegraph operations within the State for the year 1909. In addition to the usual statistics of operation of telephone companies, the board refers at some length to the work which is now under way looking toward a determination of the rates of the New England Telephone & Telegraph Company. It reviews the inventory and appraisal of the company's property which was completed last year under the hands of Messrs. D. C. and Wm. B. Jackson, Boston and Chicago, consulting engineers to the commission. This appraisal was one of the most exhaustive ever made of the property of a public service corporation, being based upon an accurate and subdivided count of all the apparatus and property of the New England company used in the conduct of its business. The appraisal showed that the property of the New England company in Massachusetts is worth $34,133,270, and outside the State $12,407,549, making the entire value of the company's property $46,540,819. Following the completion of the appraisal, the consulting engineers of the board undertook a study of the traffic conditions and operating expenses of the company. This is now being tabulated for the purpose of enabling the commission to determine what would be a fair and equitable rate under all the circumstances in any given locality. The commission hopes that very soon the telephone company and the experts of the board will agree upon some schedule of rates which can be adopted for trial in the Boston metropolitan and suburban districts, establishing fair and equitable rates for each class of service and for the subscribers in each locality embraced in any given district. It has also been the purpose of the board and its engineers to determine as nearly as possible what the cost of service has been for each particular class of subscriber.

The Massachusetts Railroad Commission has transmitted to the Bank Commissioner the following list of street railway companies which have earned and properly paid, without impairment of assets or capital, dividends of 5 per cent per annum on all their outlying capital stock for the five years ending Sept. 30, 1909: Boston Elevated, Boston & Revere Electric, Citizens' Electric (Newburyport), Dartmouth & Westport, East Middlesex, Fitchburg & Leominster, Holyoke, Pittsfield Electric, Springfield, Union (New Bedford), West End (Boston), and Worcester Consolidated. Under the statutes the bonds of these companies are a legal investment for savings banks.

The Railroad Commission has approved an issue of 4½ per cent 20-year bonds by the Brockton & Plymouth Street Railway Company to the amount of $35,000 par value, for the payment of floating indebtedness.

The Railroad Commission gave a hearing on Jan. 24 upon the plans of the Boston Elevated Railway Company for the construction of an elevated station in Causeway Street, opposite the North Station, Boston. Chief Engineer George A. Kimball explained the plans, which provide for a station 230 ft. long, with connections to the North Station of the Boston & Maine Railroad, and no sidewalk entrances or exits. Opposition by abutters was a feature of the hearing.

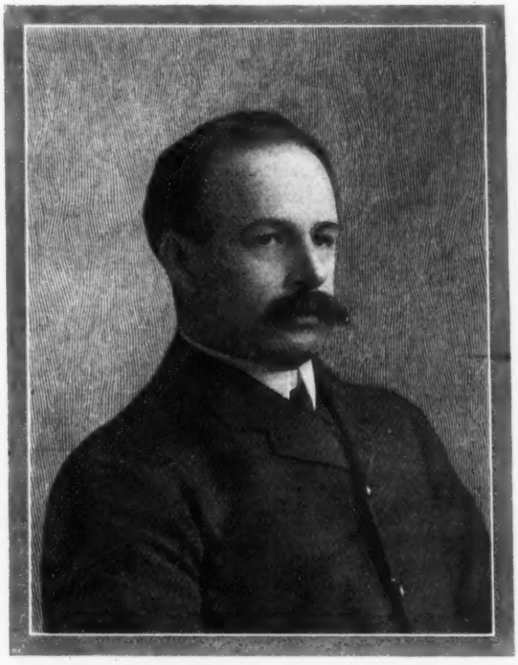
AMERICAN ELECTRICAL ENGINEERS—III.

George F. Sever.

George Francis Sever was born in Cambridge, Mass., July 30, 1866. His primary education was received in private schools and at the Cambridge High School, and his professional education in the course of electrical engineering of the Massachusetts Institute of Technology, in the class of 1887. Upon graduation he entered the drafting room of the Thomson-Houston Electric Company and remained there until 1889, holding finally the position of assistant head draftsman. In 1889 he went with the Thomson Electric Welding Company and installed welding plants in various places in the United States. In the following year he entered the employ of the Germania Electric Company, then in Cambridge, and moved its factory to Marlboro, where he was made assistant superintendent. Leaving this company in 1892 he entered the electric railway department of the Thomson-Houston Electric Company and was appointed to assist in the installation of electric-railway equipment on cars at the works of the J. G. Brill Company, in Philadelphia. In October, 1893, he was appointed instructor in the electrical engineering department at Columbia University, which position he held until 1900, when he became adjunct-professor of electrical engineering. In 1905 he was made professor of elec-

trical engineering, which position he now holds, and from June, 1905, to February, 1907, filled the office of acting dean of the faculty of applied science. In June, 1905, he was awarded the honorary degree of Master of Science by Columbia.

Professor Sever is the author of "Laboratory and Factory Tests in Electrical Engineering" and a number of books and pamphlets for use in instruction in electrical engineering. He has contributed to the *Transactions* of the American Institute of Electrical Engineers on the subjects of the resistance characteristics of insulating materials and the power consumption of electric elevators and automobiles, and is the author of a paper on "Electrolysis of Underground Conductors" in the *Transactions* of the International Electrical Congress of St. Louis, 1904. Having volunteered his services at the outbreak of the Spanish War, he was detailed by the Navy Department for coast defense work, and established the Montauk Point Coast Signal Service station, receiving an honorable discharge from the United States Navy in August, 1898. In May, 1900, he was appointed superintendent of the Department of Electrical Exhibits at the Pan-American Exposition in Buffalo, which position he held until the close of the Exposition in 1901.



Prof. George F. Sever.

During the Louisiana Purchase Exposition in 1904, he served on the International Jury of Awards.

Professor Sever has occupied the position of consulting engineer to the Department of Water Supply, Gas and Electricity in the city of New York since August, 1902, and was associated with Dr. Cary T. Hutchinson and Mr. Nelson P. Lewis on the Municipal Lighting Commission appointed by Mayor McClellan to draw up plans and specifications for a municipal lighting system for the city of Greater New York. He was intimately connected with the design of the electric power high-pressure fire-service stations in New York City, and conducted the acceptance tests of the Manhattan stations, in co-operation with Prof. R. C. Carpenter, of Cornell University. Professor Sever established the practice of electric meter testing for the City of New York through the utilization of the staff of the Electrical Engineering Laboratory of Columbia University, and supervised the codification of electrical inspection rules for the Department of Water Supply, Gas and Electricity.

Professor Sever has performed engineering work and conducted investigations for many clients, among others the Olean Street Railway Company, Olean, N. Y.; city of South Norwalk, Conn.; city of Meriden, Conn.; Richmond Passenger & Power Company, Richmond, Va.; Toronto Street Railway Company, Toronto, Can. He is a member of the American Institute of Electrical Engineers, in which body he has filled the offices of vice-president and of manager (two terms), and has been chairman of the editing committee since 1907 and member of the National Code Committee for the past three years. He is also a member of the American Society for the Promotion of Engineering Education, of the American Society for the Advancement of Science and of the Municipal Engineers of New York City.

CURRENT NEWS AND NOTES.

High Dam.—The highest dam ever constructed has just been completed on the Shoshone River in Wyoming. Its total height from the base to the parapet is 328.4 ft. It is located in the canyon of the river where the walls are nearly perpendicular and rise almost 2000 ft. above the stream. At its base the dam is 70 ft. across; on the top its length is 175 ft., while at the bottom the width is 108 ft. The dam has been constructed to control the floods of the Shoshone and to provide a water supply for the irrigation of more than 100,000 acres of land.

State Control of Water-Power.—A bill prepared by United States Senator Thomas Carter of Montana provides for the ceding of all water-power sites now owned by the Government to the States in whose boundaries they are located. The bill will further provide that the title to the sites shall remain in the States, which shall proceed to lease the sites, under proper regulations, to individuals and corporations for development. The bill conforms in large measure with some of the conclusions reached at the recent conference of Governors, and it is said that President Taft has given his tentative approval to the bill, although he is not understood to have endorsed its provisions in detail.

Meeting of Empire State Association.—An informal meeting of the Empire State Gas & Electric Association was held on Jan. 20 at Rochester, N. Y. The meeting was held in pursuance of the plan adopted at the last annual meeting to hold informal gatherings throughout the year in various parts of the State so as to give representatives of smaller properties an opportunity to be in closer touch with the work of the association. Outside of a number in Rochester who attended the meeting, about 30 from nearby communities were present. The subject of testing electric meters was discussed. The delegates were entertained at lunch at the Hotel Seneca by the Rochester Railway & Light Company and were shown other courtesies by that company which made the meeting successful and helpful.

Turbo-Generator Presented to University of Illinois.—The Commonwealth Edison Company of Chicago and the General Electric Company of Schenectady have jointly presented to the Department of Electrical Engineering of the University of Illinois a 125-kw, steam turbo-generator. The turbine of this unit is to be non-condensing. The generator is to be designed for three-phase, 60-cycle currents, to be delivered at 2300 volts. Wtih the addition of this machine the electrical laboratory will be prepared to deal extensively with problems involving single-phase, quarter-phase and three-phase currents. The significance of this announcement is increased by the fact that this turbo-generator, which is secured for the University through the interest of the Commonwealth Edison Company, constitutes the first large gift which thus far has ever been received by the College of Engineering. This gift following closely as it does after coming to the university of Dr. E. J. Berg as professor of electrical engineering, may be accepted as marking a new era in the activities of the Department of Electrical Engineering at the University of Illinois.

Steel Railroad Ties in Germany.—The production of steel railroad ties and fasteners in Germany increased from 123,000 tons in 1888 and 356,000 tons in 1906 to 494,000 tons in 1907.

Postponement of A. I. E. E. Meeting.—The Charlotte, N. C., meeting of the American Institute of Electrical Engineers, which was announced for March 23, 24 and 25, has been postponed for one week and will be held on the three days beginning March 30.

Iowa Engineering Society.—The annual meeting of the Iowa Engineering Society will be held at Cedar Rapids, Ia., Feb. 16 and 17. This is a general engineering society composed of civil, mechanical and electrical engineers. Prof. L. B. Spinney, of Iowa State College, will speak on the subject "Illuminating Engineering."

New York Electrical Contractors.—The Association of Electrical Contractors of New York at its annual convention in Utica elected the following officers: President, Mr. Edmund D. McCarthy, Buffalo; vice-president, Mr. C. A. Christensen, New York; treasurer, Mr. James F. Burns, Schenectady; secretary, Mr. George W. Russell, New York.

Worcester Show.—Fifty of the largest industries of Worcester, Mass., have contracted for space at the Mechanical, Electrical and Textile Exposition that will be held in Mechanics' and Washburn halls from Feb. 5 to 12. Prominent among the exhibitors will be the Worcester Electric Light Company and the Coghlin Electric Company.

Buffalo Electrical Contractors.—The Electrical Contractors' Association of Buffalo has elected the following officers: President, Mr. H. I. Sackett; vice-president, Mr. C. F. Sterns; secretary, Mr. E. Fleming; treasurer, Mr. E. P. McCormic; State director, Mr. J. C. Sterns. The annual banquet of the association will be held at the Lafayette Hotel on Saturday evening, Jan. 29.

The Paris Flood.—One of the most disastrous floods on record is now inundating the lower portions of Paris. The subway has been compelled to suspend service, all of the trolley lines to the eastern suburbs are out of commission, while several quarters are without electric light. Telephonic and telegraphic communications have suffered serious interruptions throughout eastern France.

Illuminating Engineering at Iowa State College.—A course in illuminating engineering has been established at Iowa State College, Ames, Ia. It is in charge of Prof. L. B. Spinney, who has the title of professor of illuminating engineering as well as that of professor of physics. Professor Spinney is possibly the first educator to bear the title of professor of illuminating engineering in an American college, although there are courses on the subject in several other colleges.

Illuminating Engineering Society.—The meeting of the New York Section of the Illuminating Engineering Society to be held on Feb. 10 will be devoted to public-schoolroom lighting. At the March meeting of the section a paper dealing with the effect of decorations and furniture upon illumination problems will be presented by Mr. C. R. Clifford, while papers discussing color values will be read by Messrs. H. E. Ives and W. D'A. Ryan. At the April meeting Mr. L. R. Hopton will discuss the design of lighting fixtures.

Corporation State Tax.—The Western Union Telegraph Company has won its suit against the State of Kansas in a case involving the validity of the Brush act, which sought to compel outside corporations to pay a charter fee for the benefit of the State schools as a condition of doing business in that State. The act was held invalid by the Supreme Court of the United States. The company fought the law on the grounds of acquired rights and claimed that the law was unconstitutional, as seeking to impose a burden upon interstate commerce.

Buffalo N. E. L. A. Section.—The Buffalo section of the National Electric Light Association, which was organized last October, now has a membership of 90. At the monthly meeting on Jan. 21 an illustrated lecture on the "Properties of the Cataract Power & Conduit Company" was given by Messrs. Alveson Hemphill and Harder of that company. At the February meeting they expect to have a similar lecture on the Buffalo General Electric Company. The membership of the section is composed of the employees of the above two companies and the retail companies at Tonawanda and Niagara Falls.

New York Lectures on Electricity.—Among the public lectures delivered under the auspices of the Board of Education of the City of New York during the year 1908-1909, were 60 dealing with the general subject of electricity. Thirteen on "Electricity and Magnetism" were by Messrs. Charles L. Harrington and Frederick W. Huntington; modern applications of electricity were discussed in eight lectures by Mr. T. I. Jones; "The Principles and Practice of Electrical Engineering" was the subject of 25 lectures by Mr. W. Wallace Ker; "The Relation of Magnetism to Electric Currents" was discussed by Prof. John S. McKay in eight lectures. Three special lectures were delivered by Messrs. W. W. Ker, A. F. Collins and M. H. Kerner.

Chicago Traction Receipts.—According to a recent decision by Judge Carpenter, the money paid into the city treasury of Chicago by the traction companies as the city's portion of the receipts under the street-railway ordinances may be used for any purpose to which the city desires to apply it. There has been some question whether this money, by the intent of the law, was not to be set aside for the sole purpose of buying the street-railway properties for municipal operation. While this point has been undecided, the money has accumulated and now amounts to something over $3,000,000. Judge Carpenter says that this fund and all additions to it can be used to build subways, or applied to any use to which the city chooses to put it.

Output of Gas and Electricity in Manhattan Borough, New York.—The annual report of President George B. Cortelyou of the Consolidated Gas Company of New York shows that during the past year the output of gas has increased in greater proportion than the output of electricity. As is probably well known, the Consolidated Gas Company owns the New York Edison Company and controls the entire output of gas and electricity of the Borough of Manhattan. During 1909 the sales of gas and electricity were approximately 24,147,506,183 cu. ft. and 249,677,504 kw-hours respectively; an increase of 1,632,371,428 cu. ft. of gas, or 6.76 per cent in the first case and 14,406,392 kw-hours of electricity, or 5.77 per cent in the second case. The number of gas meters in use at the end of the year was 777,323. At the end of 1908 there were 107,017 electricity meters.

International Railway Fuel Association.—The second annual meeting of the International Railway Fuel Association will be held at the Hotel La Salle, Chicago, on May 23 to 26, 1910. This association is formed for the purpose of obtaining greater economy in the consumption of fuel by railroads, particularly in steam locomotives, and also to participate in the national movement for the conservation of fuel resources. Mr. Eugene McAuliffe, of the Frisco Line, Chicago, is president, and Mr. D. B. Sebastian, of the Rock Island Railroad, 327 La Salle Station, Chicago, is secretary. Several papers will be read at the coming convention, and nearly all of them will be in the nature of committee reports. They will relate to the grading of fuels and various subjects relating to purchasing and accounting for fuel, as well as supervising locomotive operations to secure the greatest efficiency in fuel consumption.

TRANSMISSION LINES OF THE CENTRAL COLORADO POWER COMPANY.

The Transmission of Energy at High Voltage and High Altitudes in Colorado.

BY far the largest hydroelectric undertaking in the State of Colorado is that of the Central Colorado Power Company, the generating and transmission system of which has been under construction for several years. The installation is notable on account of the size of the territory which the system is designed to serve, the length of the transmission lines, and the high voltage employed. It is even more notable, however, because of the extremely rough and mountainous character of the country over which the transmission lines are built, the high altitudes reached by the lines and the severe and unusual climatic conditions existing at some of these high altitudes. As will be discussed in detail later, these conditions have given rise to some phenomena which have not been experienced to any extent on other lines in the United States.

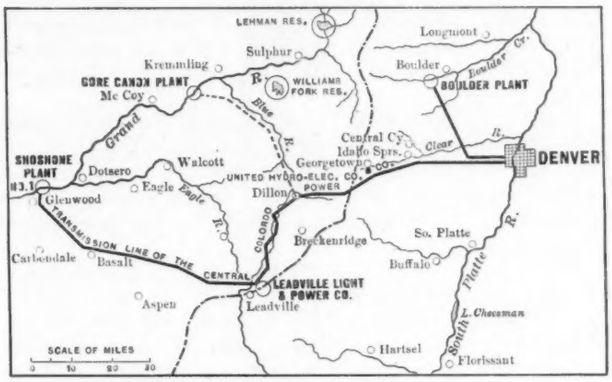


Fig. 1—Map Showing Hydroelectric Developments and Transmission Lines of Central Colorado Power Company.

GENERAL CHARACTER OF SYSTEM.

The Central Colorado Power Company was organized in the fall of 1906 and active construction work was started early in the year 1907. Its object was to furnish energy for the mining districts in the mountains of central Colorado, including those near Leadville and Cripple Creek and in Summit, Gilpin and Clear Creek counties. It was also intended to supply energy to the chain of cities just east of the mountains, including Denver, Boulder, Colorado Springs and Pueblo.

Fig. 2—General View of Transmission Line at Heli Gate.

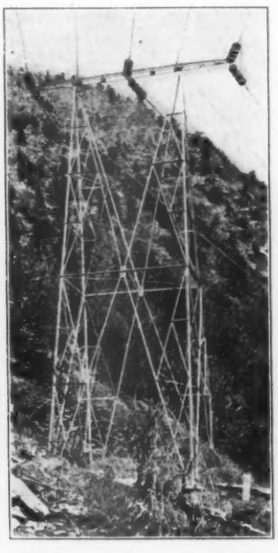
A map of the company's transmission lines, indicating the location of the power plants, substations and various towns near its lines, is shown in Fig. 1. The transmission lines indicated by solid black lines on the map are already in operation. The line between Shoshone plant No. 1, near Glenwood and Denver, was placed in operation on July 17, 1909. The line from Boulder to Denver was placed in service in September, 1909, energy being transmitted from the substation at Denver to Boulder for construction purposes at the Boulder plant. These lines are operated at 100,000 volts.

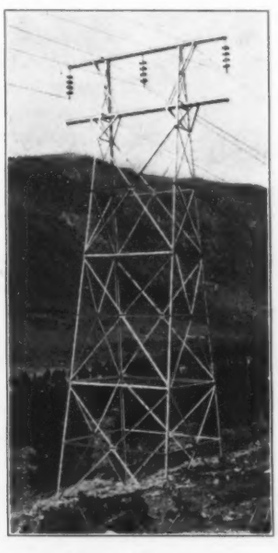
The first hydroelectric generation by the company was accomplished at the Shoshone plant No. 1, which was placed in operation on May 24, 1909, giving service at first as far as Leadville and Dillon, and later to Denver, as before mentioned. The Shoshone plant No. 1 has two 5000-kw, three-phase, 60-cycle generators. Plans for the future call for further development near Glenwood which will greatly increase the power available at that point.

The Boulder power plant is located in Boulder Canyon, about 4.5 miles west of the city of Boulder. It is expected that this plant will be ready for operation in May, 1910. It will also have two 5000-kw generators. This plant being only 28.8 miles from Denver, with no intervening mountain ranges, is to form an important auxiliary to the Shoshone plant, not only because of the greater reliability of the short low-altitude transmission line, but also because of its capacity for carrying heavy peaks for a short time, due to peculiarities of its water storage.

The plant planned for Gore Canyon is not yet erected. It is intended in later articles to take up the generating plants and substations of this system. Only sufficient has been stated here by way of introduction to give the reader a good idea of the relation of the power plants and substations to the transmission system.

The principal markets for energy at present are at Leadville, Dillon and Denver. Of these, of course, Denver is by far the largest. At Denver a portion of the load of the Denver Gas & Electric Company is carried. The two transmission lines from Shoshone and Boulder respectively feed into a substation at the outskirts of Denver from which energy is transmitted into Denver at 13,500 volts. A very interesting feature of this substation, to be described more in detail later, but nevertheless having a bearing on the transmission line, is the arrangement of outdoor 100,000-volt busbars. From these busbars, which are stretched above the switch houses by means of suspension-type insulators, connections are taken directly down to 100,000-volt oil switches. Each switch has a separate building of its own. The Boulder and Shoshone lines can be operated in parallel or independently.





Figs. 3 and 4—Single-Circuit and Double-Circuit Towers.

THE TRANSMISSION LINES.

The length of the transmission line between the Shoshone power house and Denver is 148.5 miles, although on account of

a loop connection to the Leadville substation at Leadville, the distance in circuit is 153.4 miles. The distance between the Denver substation and the Boulder power house is 28.8 miles. During the construction of the Boulder plant, therefore, the total distance of transmission to Boulder by way of Denver has been 182.2 miles.

The line between Glenwood and Denver crosses the continental divide at three points in order to get a fairly direct line. Between Glenwood and Leadville the line crosses the continental divide from the western to the eastern slope over Hagerman Pass at an altitude of 12,000 ft. It crosses again from the eastern to the western slope between Leadville and Dillon at Tennessee Pass at an altitude of 12,500 ft.; between Dillon and Denver it crosses Argentine Pass at an altitude of

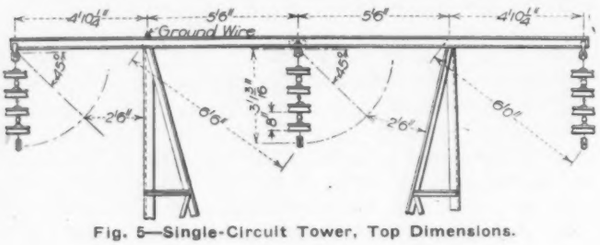


Fig. 5—Single-Circuit Tower, Top Dimensions.

13,700 ft. This latter (Argentine) pass is noted as one of the most difficult passes as regards climatic conditions. In fact, as one of the engineers put it, "The other passes over which the transmission lines run are like banana belts compared to Argentine Pass."

The severe climatic and topographical conditions at Argentine Pass made the builders of this line decide upon a duplicate line for a distance of 2.4 miles at this pass. These two lines take different routes. At Argentine Pass, wind velocities of 70 miles per hour are frequently encountered. These winds, however, are always parallel to the transmission line, as they come up the canyons approaching this pass on either side of the divide. Before reaching the pass these canyons or valleys end abruptly against steep mountain sides and apparently these abrupt endings have an effect on the wind velocity at these points.

Most of the transmission line between Glenwood and Denver, and all of the line between Boulder and Denver, is constructed on single-circuit towers. A portion of the Glenwood-Denver line, however, was constructed with two-circuit towers. While the two-circuit tower does not afford the reliability given by two single-circuit towers independent of each other, this two-circuit tower construction was adopted for a portion of the line with the idea that it would afford an economical compromise for the carrying of two circuits during the first few years of the undertaking. Fig. 3 shows a typical single-circuit tower used at a corner, and Fig. 5 the tower top dimensions. The single-circuit towers were built by Milliken Brothers. The double-circuit towers, one of which is shown in Fig. 4, were furnished by the Riter-Conley Manufacturing Company. The single-circuit towers weigh 22,000 lb. and are 44 ft. 2 in. high. The depth of their footings below the ground surface is 6 ft. The distance between footings at right angles to the line is 13 ft. and in the direction of the line 14 ft. These towers were tested by the engineering department of the Central Colorado Power Company with the results as shown in Table I.

TABLE I.—TEST OF TOWERS.

	Strain applied. Lbs.	Deflection Under load. Inches.	Permanent set. Inches.
Test load applied to cross-arm end, parallel to line	2,500	4.0	0.5
Test load applied to cross-arm centers, parallel to line	2,500	.5	0.25
Test load applied to cross-arm end, vertical downward	2,500	1.75	None
Test load applied to cross-arm end, at right angles to line	6,000	2.5	0.25
Test load applied to cross-arm end, at right angles to line tested to destruction	9,500	8.0	...

It is to be noted in Table I that the permanent set was not due to distortion of the steel in the tower, but to the yielding of the joints, which is inevitable in a tower of this kind.

Throughout the mountainous portion of the route, the actual spacing of the towers varies enormously, the location of each tower being determined by the topography of the neighborhood. Wherever it was possible to do so, a tower was placed on the top of a hill. This arrangement possesses the two advantages of allowing long spans to be used without decreasing the minimum clearance of the wires above ground, and particularly of permitting the towers to be erected where snowslides and landslides can do no damage. Full advantage was taken of the knowledge of the probable route of landslides and snowslides when it was necessary to erect a tower along a hillside, the tower being placed on a knoll or other relatively elevated location. The towers are mounted on earth or rock foundations. Where a sharp angle is formed in the transmission line the tower is merely provided with a guy wire attached direct to the cross-arm, so that no special heavy towers are required.

Fig. 5 gives the dimensions of the upper part of the single-circuit tower, showing the relative locations of line conductors and overhead ground wires. This typical pole top has been varied in some cases by the use of a second ground wire. A single-circuit tower weighs 2200 lb., while the double-circuit tower weighs 3825 lb.

Fig. 6 shows a portion of the line constructed with double-circuit towers and also the telephone line on the same right-of-way belonging to the company. On some portions of the system there is no telephone line paralleling the transmission line, as other routes are depended upon. A single-circuit tower, placed at an abrupt change in alignment of the line, is shown in Fig. 5.

Strain insulators are employed on both approaches to this tower, a jumper being placed around the insulators. Fig. 7 shows the junction of the Boulder and Glenwood transmission lines west of Denver. There is no actual junction of the transmission lines themselves. They are simply carried independently of each other on the same right-of-way.

Each transmission conductor consists of a hemp-core, six-wire copper cable having a conductivity equivalent to a No. 0

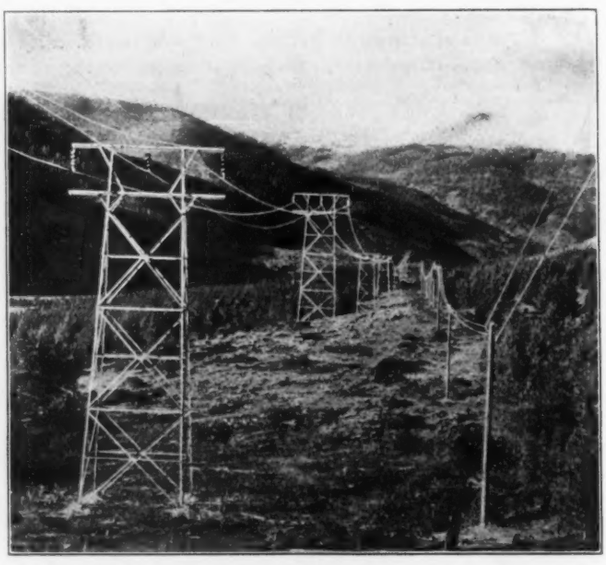


Fig. 6—Double-Circuit Towers and Telephone Line.

B. & S. gage wire, except between Leadville and Dillon for a distance of 3.2 miles, where a cable equivalent to No. 1 wire was used, and on the line between Boulder and Denver, which has a No. 1 cable.

Table II gives the engineering data on the copper cables used and also on the ¼-in., seven-strand, galvanized-steel cable used for lightning protection, as mentioned later.

The cables are erected with spans varying from 300 ft. to 2930 ft., the sag in each case being such as to prevent the

strain on the conductors from becoming excessive under the most destructive combination of low temperature, high wind and heavy sleet. The joints in the cables are made by means of copper sleeves, which are given a total of three turns and thereby rendered equally as strong as the cable itself.

TABLE II.—CABLES.

Size.	Equivalent conducting Area, sq. in.	Diameter, in.	Elastic limit, lb. per. sq. in.	Tensile strength.
*No. 0.....	.0829	.375	35,000	61,000
*No. 1.....	.0657	.330	35,000	61,000
†¼ in.....	.0492	.25	37,500	62,000

*Six strand hemp copper.
†Seven strand steel.

The line sag curves used for guidance in the construction of this line with No. 0 cable are shown in Fig. 8. Copies of these curves were printed on blueprint cloth for use in the field by the line construction gang.

The curves are in reality sections of a single catenary curve representing to scale the form that would be taken by the conductor when stretched between the points of support at a tension of 30,000 lb. per square inch under the conditions assumed. Evidently the curves measured from the center of the span are identical in all respects, quite independent of the length of the span, and hence the vertical distances along the curve properly represent the sag for spans corresponding to the half-lengths indicated.

At each tower the conductors are separated from the supports by four General Electric suspension-type disk insulators, 10¼ in. in diameter. Each disk is rated at 25,000 volts working potential, and the four at 100,000 volts. These disks are joined in series by two horseshoe horns of No. 1 copper wire, the upset ends of which are held together by means of galvanized-iron clamps bolted in place. This type of support has proved thoroughly reliable, and there is no evidence of the metal crystallizing.

The three cables are supported from a single cross-arm in a horizontal plane, the separation between adjacent conductors being 10 ft. 4 in. From the cross-arm to the foundation the distance is 44 ft. and the clearance of the wires above ground at the towers is 40 ft. A lower cross-arm is utilized for transposing the cables, which is done at 20-mile intervals. Along the upper cross-arm, midway between the two outer cables and the middle cable, are strung two grounded cables for protection from lightning. These cables, being Siemens-Martin galvanized strand ¼ in. in diameter built up of seven wires, are bolted in place on the towers by galvanized-steel clamps. Along parts of the route not particularly exposed to lightning storms, and more than five miles from any station or substation, one of the grounded cables is omitted.

Fig. 9 shows the dimensions of the suspension-type insulator used, and the distance between the porcelain disks which make up this insulator.

The footings of the towers are set not less than 5.5 ft. below the surface of the ground and in nearly all cases the footings are set in loose earth or rock. In a few cases the footings are set in solid rock by drilling and grouting special footings. Several of the towers located in marshy ground have been set in concrete.

It will be appreciated that extraordinary care had to be exercised in placing the towers to insure permanancy in location and immunity from destruction. The conditions of wind, sleet, snowslides and landslides are unusually severe; as is well known, snow and land are not stable features of the mountain scenery in Colorado. However, the lines of the company have been singularly free from breakages.

A private right-of-way was secured for the entire line. This right-of-way is 100 ft. wide, through the forest reserve and on all parts of the line, excepting the approach to Denver. At a distance approximately eight miles from Denver, where the land is more valuable and not mountainous, the right-of-way is reduced to 65 ft. Through the forest reserve a contract was made with the Government for the right-of-way. Elsewhere titles to the right-of-way or easements are being secured throughout the entire length of the line.

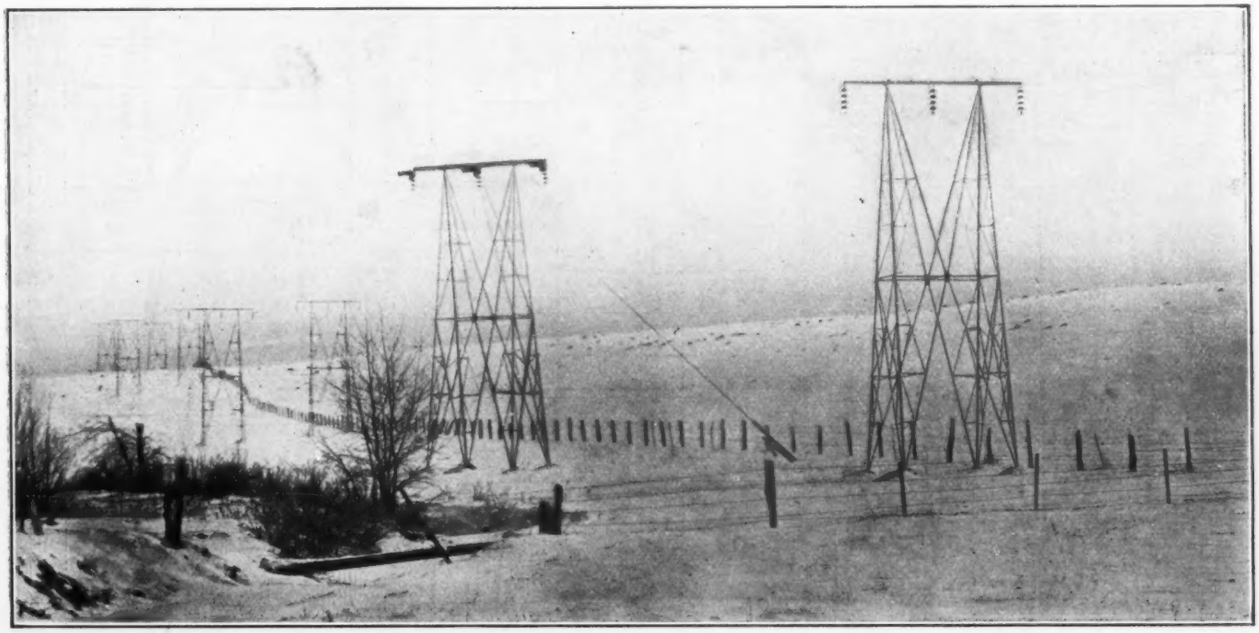


Fig. 7—Two Transmission Lines over Same Right-of-Way.

OPERATING.

The results attained in the operation of this line under such unusual and strenuous conditions are of much interest to high-voltage transmission engineers and investors.

Thirty-two miles of this line was first operated for more than six months at 86,600 volts for transmitting energy from a steam plant at Leadville to a substation at Dillon. Although no lightning arresters were in use during the summer of 1908, the total delay occasioned by lightning was only 17 minutes, all of which represented time consumed in placing the apparatus in service after the oil switches had opened on account of induced surges. No damage was caused by lightning to either the line or the apparatus.

As before stated, transmission at 100,000 volts between Shoshone power house No. 1 and Denver was begun on July 17,

1909. Operation during the last half of the summer lightning period of 1909 was carried on without lightning arresters and without serious troubles from lightning. Experience so far indicates that winter conditions are more difficult to contend with than summer conditions, although newspaper reports to the effect that the line would have to be rebuilt on account of breakages caused by winter sleet storms and snowslides are entirely without foundation. It has been found that sleet and snow sometimes cover the line conductors so that they have an outside diameter of 6 in. and at the top of Argentine Pass ice and snow have accumulated on the insulators until they were frozen solidly to the tower. At present writing nothing has occurred to indicate that such ice coatings on the insulators cause any trouble when energy is being transmitted at 100,000 volts.

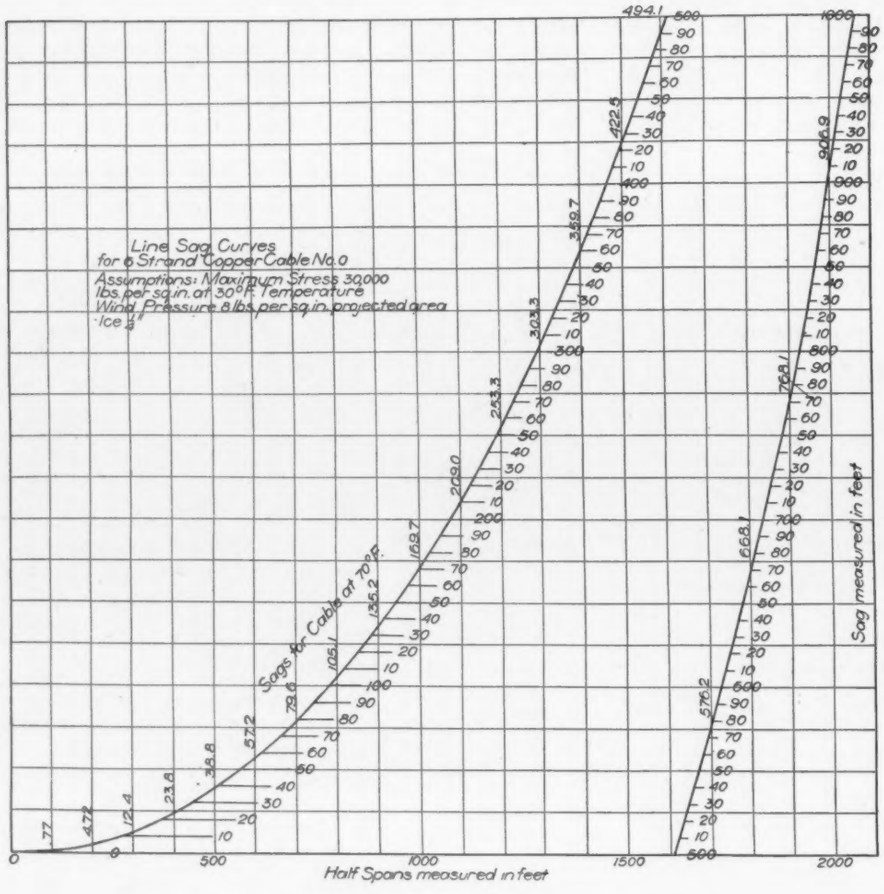


Fig. 8—Line Sag Curves.

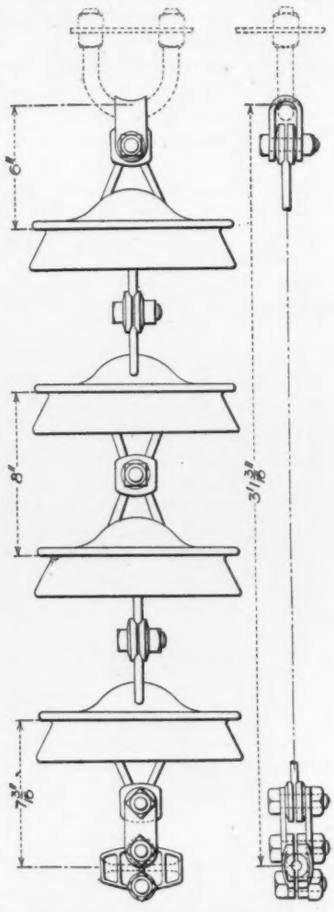


Fig. 9—Insulator for 100,000 Volts.

A very severe storm late in 1909, which gave rise to the newspaper reports referred to, caused two breakages, one of which was due to an unobserved defect in a guy wire. The only other trouble was a single break in a transmission cable. This was the result of an unusually severe storm. Some of the line having been built previous to the winter of 1908 and 1909, opportunities were given to correct defects in location before service was begun on these portions.

Although operation in summer without lightning arresters gave rise to no unusual lightning conditions, static phenomena have been observed in cold weather which are out of the ordinary and of considerable interest. At high altitudes in cold weather when dry snow is being blown across the line, arcing sometimes takes place between the overhead ground wire and one of the line conductors. This arcing usually allows enough current to flow to cause a slight drop in voltage for an instant at the substation. In the majority of cases when it occurs the current flowing is not sufficient to trip the overload devices on the oil switches at the generating plant. As nearly as can be determined, the arcing usually takes place about 100 ft. from a transmission tower. The only evidence the arc leaves is slight cavities on the cables between which it occurs. It has never reached sufficient volume to melt away any appreciable amount of metal from the cable. The volume of current flowing is evidently very low.

The minimum possible distance between the overhead ground cable and the nearest transmission line conductor can be judged from Fig. 5. The transmission conductor is nearer to grounded parts at the transmission tower than at any point between the towers for the reason that more sag is given to the transmission conductors than to the overhead grounded cable. Should the wind blow a transmission conductor to one side, so that its insulators assume an angle of 45 deg. to the vertical, as indicated in Fig. 5, the distance between the transmission conductor and the steel of the pole would be 2 ft. 6 in., which is a much less distance than could exist between the transmission conductor and the overhead ground cable. As far as observed, however, the arcing takes place between cables some distance from the pole. It is thought that the arcing is due to static charges on the line caused by dry snow and wind, which give rise to sufficient potential to strike an arc across this great distance. It is rather remarkable that an arc having once been established between line wires in this way is not maintained by the generator current from the power houses. In this connection it must be considered that not only is the Central Colorado Power Company's 10,000-kw generating plant at Shoshone in operation connected to the line, but this is operating in parallel with the large steam plant of the Denver Gas & Electric Company. The amount of power available to maintain an arc once established is, therefore, considerable.

The president of the Central Colorado Power Company is Mr. J. R. McKee; the general manager, Mr. G. H. Walbridge, and the electrical engineer, Mr. P. T. Hanscom. The undertaking was organized by two of the vice-presidents, Messrs. Curtis and Hine, of Colorado Springs.

A LARGE INDUSTRIAL PLANT SWITCHBOARD—I.

Description of Controlling Devices for a Gas Engine Generating Equipment.

By WARREN H. MILLER, *Electrical Engineer, Standard Oil Company.*

IN Fig. 1 herewith is shown an alternating-current switchboard 42 ft. long containing five generator and 10 feeder panels, together with the necessary station panels, designed by the writer for the power house of the Bay Way Refinery of the Standard Oil Company, and built and erected by the Walker Electric Company, of Philadelphia, Pa. The refinery covers five square miles of territory, and the electric power is furnished by three 700-kva, 480-volt, three-phase, 25-cycle alternators driven by horizontal double-acting gas engines, running on oil-distillate gas, which comes off in enormous quantities from the crude oil during the process of distillation, and is sometimes burned at considerable loss under boilers and stills and the excess wasted into the air. The power house is quite centrally located so that heavy 480-volt feeders can be run directly from the generators to separate departments; there are a few, however, that are fed with energy at 2300 volts for transmission.

In designing this board the writer followed the usual procedure of laying out and calculating all the lamp and motor circuits and then making the feeder panels to match, having due consideration for future increase. The size of any one feeder line was, wherever practicable, limited to No. 4-0 stranded cable not only for construction reasons, but also in recognition of the well-known fact that the transmission loss is greater with three heavy wires than with six lighter ones, which comes economically into consideration in sizes of about 4-0 and larger. A direct result of this policy was considerable uniformity on the switchboard with the feeder panels, six of which were identical. For the lamp service three centers of distribution were selected, one of them being the power house itself, and a 480-volt, three-phase line was run to each of the other centers, where the e.m.f. was decreased to 120 volts in a bank of three 15-kw transformers. These three-phase lines required two other panels on the board, the power-house special circuit another, and the last of the 10 was a 2300-volt, 300-kw oil-switch panel.

Of the five generator panels, two control 300-kw steam reserve equipments and the other three the 700-kva gas-engine equipments. As the oil-distillate gas has a very high heat-unit content (from 1200 to 1800 lb.-Fahr. units per pound) and very much more rapid in its ignition and violent in its action than natural gas or gasified crude oil, the paralleling of the generators is very difficult and every possible feature in gas-engine governing, generator design and switchboard facilities that will aid in meeting the requirements of the gas for parallel operation is taken advantage of.

In this connection it may be mentioned that at Philadelphia, where four 400-kva machines have been running for several years with similar gas, the switchboard has four separate main buses, with interconnections for the engines and feeders. From a study of the fairly good parallel operation that was eventually obtained at that plant, it was felt safe to dispense with an elaborate and unwieldly arrangement and to use only one set of main buses and one emergency set. Some form of emergency equipment is absolutely essential with high heat-unit gases, as it often occurs that one engine will develop some defect that will keep it from being paralleled with the others and yet it will be able to carry nearly its rated load. For instance, in the course of several weeks' steady run the keepers of the piston rings often get burned, permitting the exploding charge to shoot over the rings, thereby making trouble for the next incoming charge and causing so many irregularities with the impulses to which the gas engine owes its uniformity of rotation as to make it impossible to run it in parallel with the others. Again, it may be that this engine will be so slow in action that it will hardly take a fraction of its rated load when in parallel, but will carry the whole of it when operating alone and thus be able to drop its speed a few cycles. In either case an emergency bus is the best means for placing a lead on such an engine, and it does not complicate matters to any great extent to have one.

In the board at Bay Way the emergency bus, with a capacity of two generators, is placed on a bracket at about the level of the main switches, all of which are of the double-throw type. The main bus brackets run along at the level of the ammeters on the upper part of the middle section. The center panel of each of the three refinery and three paraffine feeders is made 24 in. wide to permit a double-throw switch to connect either the emergency or main buses with either or both of these departments, thereby placing a load of about 600 kw on the defective engine.

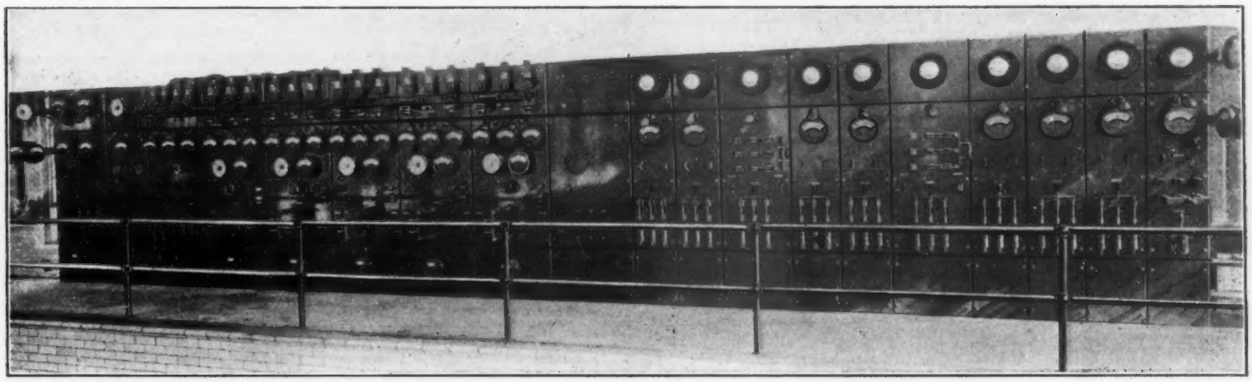


Fig. 1—General View of Front of Switchboard at Bay Way Refinery.

It was at first proposed to make the double-throw feeder switches differential—that is, with knives bent at the middle pinion at such an angle that as one side is leaving the clips the other side is entering, thus transferring the load from main to emergency bus without opening the circuit. The idea was abandoned because it connected the engines simultaneously on the emergency and main buses at the instant of transfer, and, unless the generator double-throw was sent over first, there might be a mistake and the two sets of engines be put together while out of step. To make it absolutely foolproof the feeder switch was made double-throw instead of differential and it works out very well in practice.

To isolate one engine and one set of feeders, the engineer stands at the generator panel and the shift electrician at the feeder, while the oiler manipulates the engine throttle. As soon as the driving power has been reduced to, say, 100 kw, the shift electrician connects the feeder to the emergency bus and the engineer at once closes the generator switch. The oiler then spins open the throttle and the engine and load are thus transferred with hardly any arc. The change is unnoticeable at the induction motors except for the inevitable momentary stoppage of the hum; it is doubtful if even synchronous motors would be disturbed.

Another special feature of the generator panels with regard to parallel operation is the use of "Dalite" time-limit circuit-

breakers to take care of surging in parallel. These are of 1200-amp rating, and are provided with a mechanical direct-acting time-limit feature. This device does not depend on any electric relay whatever, but is a very compact little attachment which depends on the adhesion of two oil-covered disks for the delay in its releasing. With any given force tending to pull them apart it has been found that the time required for the viscosity of the oil to release the disks varies directly and invariably as the amount of surface in contact. By making the disks segmental, the time can be adjusted from about 1 second to 30 seconds by simply turning a handle for the purpose. Moreover, the time-limit does not integrate like a fuse. For instance, if the overload causing the circuit-breaker catch to release acts on the time-limit attachment for 15 seconds, and it is set for 20, it not only will not release until the 20 seconds are up, but if the overload is taken off for even a very short time it will again require the full 20 seconds to cause a release instead of an extra 5 seconds as would be the case with a hot fuse.

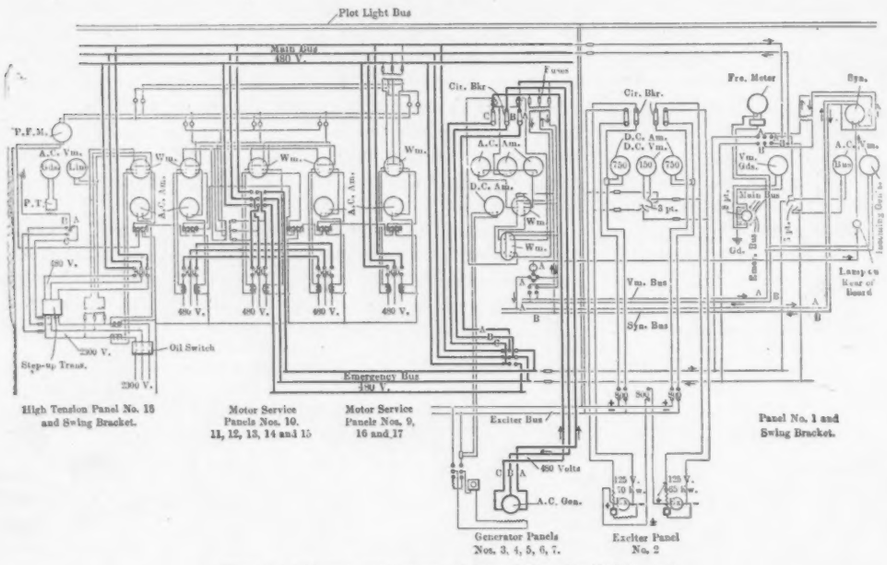


Fig. 2—Wiring Diagram of Bay Way Switchboard.

The time-limit feature is of much value for gas-engine work because, on very light loads, poor runs of gas, etc., a great rumpus is often started by one engine misfiring and then backfiring through the exhaust pipe. This action generally affects all of the other engines since the whole load of the backfiring engine is suddenly thrown on the others, whereat the one getting the most of it backfires. These disturbances often quiet down and pass off, but again often increase so as to blow a main fuse on the board before getting a good chance to quiet down, thus causing further trouble and shutting down one or more departments.

For the above reasons it was decided to avoid main generator fuses entirely. Of course, a plain circuit-breaker would be worse than useless, but one with a time-limit feature substituted for the fuse would enable the engines to quiet down, if possible, and would open on a series of surges extending over 20 seconds or more as experience would show best.

On the generator panels use was made of knife switches instead of oil switches because breakers had been provided to open the circuit, and the economy of a good knife switch, with its drop of only 6 millivolts instead of the possible 70 millivolts of the oil switch, was worth considering. When breakers are not used oil switches are certainly preferable in spite of their complications because it is not easy to break 1000 amp on any voltage in an emergency, as sometimes must be done about a power house. Burned hands and ruined switch clips are the usual result unless the break is made in oil.

A detail often overlooked until too late is the fine wire resistor placed across the field-circuit switch. This resistor should be furnished by the generator company, but is usually overlooked in the generator specifications and left to the switchboard company. Whereupon, when ready to start up, no one has furnished it, and one must either tie up the quick-break switch and pull a long arc on the field switch or else rig up a temporary bank of incandescent lamps until the proper resistor arrives. The induced field kick from the Bay Way generator is strong enough to destroy three 110-volt lamps in series and may puncture the insulation if the switch is snapped off quickly without any resistance at all.

On the standard feeder panel the knife switches, as are those on the generator panels, are sold under a guarantee of 6 millivolts drop from stud to stud. This economical performance cannot be obtained except by first mounting the switches on the board and then grinding them in by hand until fine, smooth surfaces are obtained. The ordinary switch, stuck on and screwed fast without any subsequent grinding, has from 60 millivolts to 150 millivolts drop, and the least arcing will so localize the available surface through which all the current must flow that the switch heats up at once (by conduction) and all the temper is taken out of the clips; this action renders them useless and it is impossible for the works electrician to repair them.

In considering the use of ordinary circuit-breakers on these panels the tests shown in the accompanying table were made on various types and sizes of fuses to determine the effect of the ordinary drop in millivolts around each. As a good breaker is sold under a guarantee of not more than 10 millivolts drop (though some makes do run as high as 80 millivolts), the yearly economy of breakers over fuses will pay for them as the following figures go to prove:

E.M.F. DROP AROUND 250-VOLT FUSES, EXPRESSED IN MILLIVOLTS.

	400 Amp Type "A."		400 Amp N. E. Code.		600 Amp Open-Link.		800 Amp Open-Link.	
	Cold.	Hot.	Cold.	Hot.	Cold.	Hot.	Cold.	Hot.
A..	16	18	2	3	19	20	9	11
B..	82	92	72	82	57	65	56	65
C..	1	2	2	2	½	1½	1	1½
D..	120	128	76	80	85	99	82	90

The total millivolt drop around a 600-amp fuse is about 100, as was shown by the tests. This loss equals 60 watt-hours per hour of salable energy, or 525 kw-hours per year per leg, or 1575 kw-hours per feeder per year. This energy at an average sale price of 7 cents per kw-hour is worth $110.25; as the loss in the circuit-breaker is only one-sixth as large, or $18.33, there is a profit of $91.92. This value is for city power houses. For industrial plants the saving will only be about one-half as large with energy at 3.5 cents per kw-hour, but even then it will pay for the breaker in a year. In the case of its opening during a thunderstorm the breakers can be closed without shutting down the department, while with fuses at least a half-hour's delay ensues before service is restored.

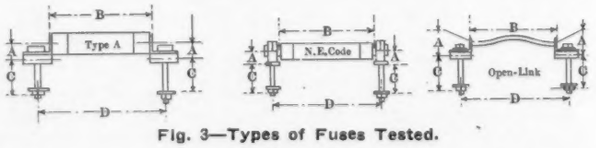


Fig. 3—Types of Fuses Tested.

With the large gas engines the sale value of the energy is only 0.25 cent per kw-hour due to the low cost of the distillate gas, so the writer selected other much-needed electric equipment instead of the breakers. The fuses detract from the appearance of the board unless given a coat of black enamel, but

they should never be put on the rear side, where it is a matter of great danger to replace large fuses, especially in the hurry and excitement incidental to blowing of fuses of the circuits to some large department.

On the high-tension panel, which comes last in the line of feeders, the fuses are on the high-tension side with marble bases and a special wooden claw-handle for removing and replacing them. The panel connects three 200-kw oil-cooled, single-phase, 25-cycle transformers to the line and the buses. The meter is on the bus side of the transformers. By its reading, the transformer losses at both ends can be ascertained by subtraction of the readings of the department meters a mile away along the works water front.

A novel feature of this group of feeder panels is that of a power-factor meter for reading the power factor of any one of the feeders at will. It is installed on a swinging bracket above the high-tension voltmeters. The usual function of this meter has been simply to give the general power factor of the system by direct connection to the bus transformers. This information is not of as great value as it would be if the power factor of each feeder could be known separately, for a record of the latter is a very good check on the methods of handling the motors in the works, and shows whether the departments are being over-motored or under-motored. For these reasons the writer determined to have such an arrangement on the board, and on the principle on which the necessary connections are made is that to ascertain the power factor of any feeder use must be made of a connection to it from its voltage transformer and from its current transformer, the connection being from one leg only because the instrument is of the single-phase type. To make the proper connections to the transformers to which the wattmeters and ammeters are joined one leg is taken of each and the other legs are connected to common wires running to the voltage and amperage terminals of the power-factor meter. For the voltage leads there was required simply a main to which any feeder could be plugged; on the amperage side each separate series transformer was arranged for its own wattmeter, and, hence, a special two-way plug was devised that would connect the wattmeter and shunt the power-factor meter or would connect the power-factor meter in circuit and disconnect the wattmeter as desired. The arrangement is very compact and introduces very little complication in the wiring.

DETERMINATION OF CONSTANTS OF INSTRUMENT TRANSFORMERS.

By F. A. Laws.

IN all alternating-current plants the measurement of the output, current and voltage, as well as the operation of the various safety devices and instruments, such as power-factor meters and frequency meters, rests on the employment of instrument transformers, their use being dictated by conditions of both safety and convenience. On these instruments rests a great responsibility as to just financial returns for money invested, and this fact amply justifies the very considerable detailed study to which they have lately been subjected.

From the standpoint of the instrument user, the constants which are of importance are the ratio and angle of defect, or phase displacement of the current in the secondary from exact time-phase opposition to that in the primary.

The determination of the transformer ratio is simply the determination of the ratio of two currents. For direct currents use may be made of the connections, shown in Fig. 1, which in various forms are employed in all standardizing laboratories.

If the detector shows no current, then

$$\frac{I_1}{I_2} = \frac{R_2}{R_1}$$

When alternating currents are to be compared, the resistors, R_1 and R_2 of Fig. 1, must be non-inductive, I_1 and I_2 of the same wave form and frequency and in time-phase, or if certain forms of detector be used, of a known phase difference. Various suggestions looking toward the employment of this general arrangement for determining the current ratios of series transformers have been made and undoubtedly it is this method which will finally be perfected and used for the purpose. I_1 and I_2 may be the primary and secondary currents of the series transformer, in which case they are usually in time-phase to within a fraction of a degree. As a detector, a D'Arsonval galvanometer may be employed, as suggested by Mr. L. T. Robinson, its terminals being reversed by means of a commutator driven by a synchronous motor. If the movable coil of the detector be connected directly to the terminals of R_1 and R_2, the field in which it swings must be reversed synchronously

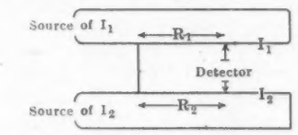


Fig. 1—Balance in Direct-Current Circuits.

with, say, the current I_1; this method suggests that I_1 be led through the fixed coil of an electro-dynamometer while the movable coil is connected between R_1 and R_2. The dynamometer is brought to zero by varying the resistance of R_2, which may be a slide wire of about 1/10 ohm resistance. This scheme of connections, which was in use at the Massachusetts Institute of Technology during the winter of 1908-9, is the same as that described by Messrs. Agnew and Fitch in the issue of the *Electrical World* for Oct. 28, 1909. As in the series transformer there is a slight time-phase displacement between I_1 and I_2, the dynamometer will stand at zero when the mean product of the currents in its two coils is zero. Then

$$\frac{I_1}{I_2} = \frac{R_2}{R_1} \cos \beta$$

where β is the angle of defect of the transformer. In practice this method has a serious defect, for the sensibility falls off as the square of the current; and hence, in order to cover a wide range, several dynamometers are necessary. Consequently, this method was discarded at the Institute and the following arrangement was adopted:

In Fig. 2, D_1 is the detector dynamometer; its fixed coils are traversed by a current of about 8 amp derived from the secondary of a phase shifter; if the phase displacement of I and I_1 be Δ, and the angle of defect of the transformer β, the mean product of the currents in the coils of D_1 will be zero when

$$\frac{I_1}{I_2} = \frac{R_2}{R_1} (\cos \beta + \tan \Delta \sin \beta)$$

It is seen that convenience dictates that Δ be zero, or that I and I_1 be in time-phase. To facilitate this adjustment is the function of dynamometer D_2 the movable coil of which by the

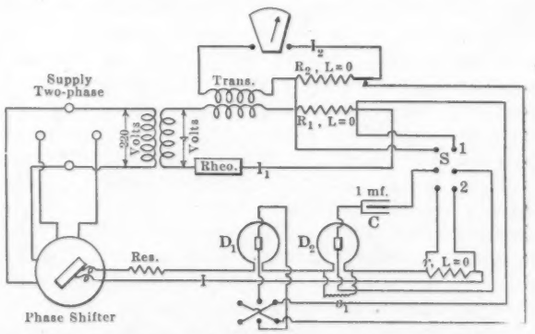


Fig. 2—Arrangement of Apparatus for Alternating Tests.

double-throw switch S may be put across either the resistance r or R_1; in series with the movable coil is a good condenser of about 1 mf capacity. With S in position 2, the dynamometer D_2 will show a small deflection, because the resistance in series with the condenser is appreciable; by adjusting the non-inductive shunt s_1, this deflection may be reduced to zero. Switch S is now thrown to position 1, thereby connecting the movable coil circuit of D_2 across R_1 which is carrying the current I_1.

In general, there will be a deflection; by moving the phase shifter the deflection may be brought to zero, which means that I and I_1 are in time-phase or that the flux through the current coils of D_1 is in time-phase with the current I_1. The slider on R_2 is now varied until D_1 is brought to zero. Then, nearly enough for all practical purposes,

$$\frac{I_1}{I_2} = \frac{R_2}{R_1}$$

The reversing switch is for the detection and elimination of any transformer action between the coils of D_1.

The method here described gave good results, but was slow of execution on account of the long period of vibration of the dynamometers and their lack of adequate damping. The frequency with which series transformers must be checked demands some arrangement by which the ratios can be determined with rapidity to, say, 1/10 per cent. For this purpose the arrangement shown in Fig. 3 was devised.

The instrument D is what might be called a string, or better, a strip, electrodynamometer. The ring is built up of punchings and has an air-gap of ⅜ in. at a. The cross-section of the iron is 2⅜ in. x 1½ in., the diameter of the ring 8 in., and the winding of 240 turns takes 3 amp at 110 volts, 60 cycles; the resistance is 2.4 ohms. Through the air-gap hangs a piece of flat suspension strip 14 in. long, such as is used in D'Arsonval galvanometers; the lower end is amalgamated and dips into a mercury cup ¼ in. in diameter. The strip is straightened and rendered limp by passing a current through it while it is under

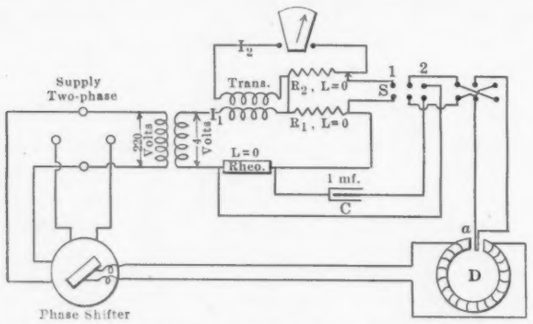


Fig. 3—Improved Arrangement of Apparatus for Alternating-Current Tests.

tension. When the strip is lowered into contact with the mercury and then raised, it immediately centers itself in consequence of the surface tension. The return lead from the upper terminal is brought down in the same plane with respect to the lines of force as the strip, thus doing away with any transformer action; the position of the return lead is regulated by a screw adjustment. The resistance of the suspended system is about 2 ohms. The plane of the strip is in that of the lines of force and its edge is viewed by a reading microscope, the zero position being coincident with the cross-wire. The period of vibration is about one-half second; air damping is sufficient. The current I_1 is regulated by a non-inductive rheostat, and if the leads are of ample size, the potential difference between its terminals will not be subject to extreme variation. To bring the flux at a into time-phase with I_1, the strip, in series with a first-class condenser, is put across the rheostat; the current in the strip will be nearly enough in time-quadrature with I_1. The phase shifter is then turned until the strip again coincides with the cross-wires of the microscope.

After the adjustment of the time-phase of the flux at a to that of the current I_1 the switch is thrown to position 1 and the slider is adjusted until the strip again stands at zero.

$$\text{Then} \quad \frac{I_1}{I_2} = \frac{R_2}{R_1}$$

The time required to make and check the settings is about one minute. The speed of working obtained indicates that the method is adapted for use in laboratories where economy of time is essential. Its sensibility is ample and diminishes only as the first power of the secondary current.

THE ELECTRIC MOTOR IN PRINTING WORK.

Applications to Print-Shop Auxiliaries.

By S. H. Sharpsteen.

When proper consideration is given to the driving motor and controlling devices of the printing apparatus energy consumption per unit of work done will be small. When this condition is reached the extensive printing industry will commonly use electrical apparatus and, as the enterprising business man usually keeps in close touch with the printer, he will be influenced by the report of the printer as to the low operating expense with increased production.

PAPER CUTTER.

The selection of a proper paper-cutter drive seems like a simple proposition, but if no data as to power required to start and drive it are at hand, the better plan is to belt a motor to the machine temporarily for the purpose of obtaining the data. A good motor should withstand 100 per cent overload current for at least 10 seconds in starting the cutter flywheel and accelerating it to full speed without sparking at the commutator. If there is any doubt concerning commutation the motor should be sufficiently compounded to insure absence of sparking.

As a rule, where use is made of only one cutter driven by an individual motor, only a little of the energy consumed by the equipment is used for production, because for much of the time the motor simply drives the cutter shaft and flywheel. This is the essential reason for using a motor of small size.

If it is found that when the heaviest cut is being made the current runs above the amount taken to start the flywheel in 10 seconds it would be better to place a heavy driven pulley on the cutter than to increase the motor size. The use of this pulley will reduce the excessive torque on the motor at the frequent cuts and usually the motor will not have to be started from rest so frequently.

The printer should be impressed with the importance of having the paper so arranged as to be pushed through in a manner to keep the cutting equipment busy while running and thus lower the energy consumption in proportion to work done.

When several cutters can be grouped and driven from one shaft and the operators are properly instructed to shift the belts to the loose pulleys before the motor is brought to rest and not to shift all of them back simultaneously when starting, the single motor rating can be reduced at least one-third below that of the combined ratings of several individual motors.

With group and shafting drive the shafting and pulleys, as well as the cutter wheels, store up energy to force the knives through the goods being cut. When this method is used a man doing piecework might break a cutter by placing too much paper under the knife at one time, as the machine not only must withstand the driving of its own flywheel, but that of the other cutters belted to the line shaft.

The printer that contemplates driving a number of cutters in a group with a motor would do well to have a competent engineer plan the drive. It is evident that a line shaft sufficiently strong for the work could be twisted off by having the belt of a cutter forced onto the tight pulley in an attempt to start a heavy flywheel quickly when the cutter is belted to one end of this shaft while a number of flywheels are driving it along the remainder of its length.

Paper cutters are being driven with motors rated at 1 hp, 2 hp, 3 hp, 4 hp and 5 hp, the rating depending usually on the size of the machine driven.

LINOTYPE MACHINE.

When a linotype machine is sent out by the manufacturer with an electric motor it is apt to be poorly arranged for driving. It may seem a little queer that this famous piece of composing apparatus should be so equipped by the makers, but the reasons are probably commercial. The builders are accustomed to large profits. In order to compete with local contractors and motor people they are compelled to use inexpensive motors and controllers. The result has been damaging to the individual motor method of driving and some prominent news-

papers are using the group method. The motor for operating this machine should be of 0.25-hp rating, based on a 10-hour run, and constructed to withstand starting by means of a snap switch. The switch should be placed where it is handy for the operator to turn on and off without leaving his seat, so that he will be likely to acquire the habit of shutting down the motor when the machine is not in use.

Almost any 0.25-hp motor designed for the proper low speed will withstand starting the linotype driving shaft without the insertion of resistance in the armature circuit, even though it be not of the compound-wound type. These motors vary in speed from 600 r.p.m. to 800 r.p.m., depending on the shaft to which they are belted. In cases where a very special motor is installed and a small pinion on the motor shaft meshes into a large gear on the linotype machine, a lower motor speed is sometimes used. The question of new parts and repairs dictates the selection of some established standard type.

Where a plant is to be changed to motor drive and individual motors are to be used they should be inclosed fairly tight to keep out type metal. The most feasible plan is to place them on a small base back of the linotype machine on the floor. The fact that this arrangement does not admit of moving the linotype machine without taking up the motor is of no importance. When the motor is supported mechanically from the linotype machine, it is much more difficult to make motor changes in case of a breakdown.

Operators differ in their requirements of working speeds, especially when the piecework system is in use, and in many cases the voltage will vary during the day, hence it is desirable to provide for at least a 10 per cent speed variation by means of a small field-circuit rheostat located where the operator can reach it easily.

One of the New York City dailies in a new installation is using group drive with four machines belted to one shaft, each shaft being driven by a 1-hp motor.

This plan was recommended by a man in charge of the machinery in a large newspaper establishment where individual drive was being used. Being installed in groups of four it is quite an easy matter so to plan the work as to minimize the energy consumption when only part of the machines are running. It is not so flexible a scheme as the single-motor arrangement when the desirability for speed variation and the unsymmetrical positions of the linotype machines are considered, but it is probably as economical in energy consumption. Since the belt pull is upward on the shafting, assuming that the shafting is run along the floor, use should be made of ring oil bearings in the hangers, because the shaft is liable to touch only the upper half of the hanger bushings. Experience has proved this to be true when linotype machines are placed with their backs together and are driven by the shafting running between the two rows. This arrangement places the linotype machines close together and the many short belts pulling upward lift the line shaft so that it runs against the top portion of the hanger unless it be exceedingly heavy in proportion to the power transmitted. Unless the motor is so hung from the linotype machine that its weight causes it to swing in a direction to keep the belt tight, experience has proved that a well-constructed idler pulley placed on the motor and held against the non-pulling side of the belt gives better results. The idler pulley should be sufficiently large to allow the use of a bushing or bearing metal that will require no oil for lubrication and thus dispense with the nuisance of getting lubricant on the belt. The right bearing in a properly designed and constructed idler pulley belt tightening rig, if placed on the non-pulling side of the belt, will require very little spring tension and care to cause it to make the belt hold properly.

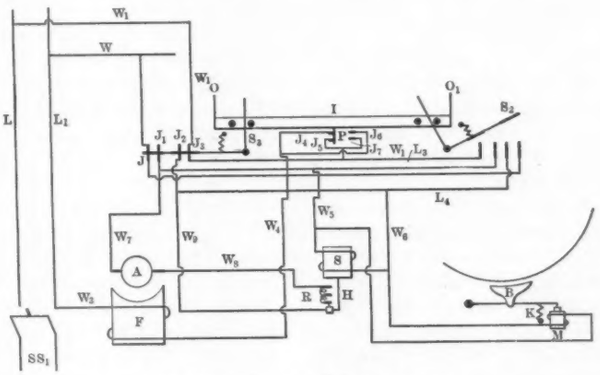
The working conditions of an individual motor drive for a linotype machine is improved by placing a balance wheel on the motor pulley. The manufacturers claim that if the linotype machine is in good condition and the operator attends properly to his business the flywheel is of no use, but any operator who has used an equipment with a flywheel prefers it for driving the linotype machine.

MATRIX ROLLER.

The matrix roller is, in most instances, used only a few minutes in the 24 hours and in many cases is belted to a motor that runs during the whole working time of the force.

If a new machine is to be arranged for motor driving it should be so designed as to permit of attaching some reliable motor. If one is being driven by shafting and is to be changed to individual motor drive a 2-hp or 3-hp motor can be placed alongside of it on the floor and belted to it.

The accompanying diagram shows a plan of control and wiring for a matrix roller. When the service switch *SS* is closed, voltage is placed on the lines *L* and L_1. When the matrix is on the table, ready to be rolled, the operator pulls the handle *O*, thereby moving the shifter bar *I* to the left and forcing the switch S_3 into the jaws *J*, J_1, J_2 and J_3 and the small field switch *P* into the jaws J_4 and J_5. The field *F* is now excited by current passing through the wire W_3, coil on *F*, wire W_4, switchblade *P* and wire W_1. The bus L_3 is connected with line L_1 by means of wire *W*, jaw *J*, a portion of the blade of switch S_3 and jaw J_1. The bus L_4 is connected to line *L* by means of wire W_1, jaw J_2, and J_3, a second portion of the blade of switch S_3 allowing current to pass, thus exciting the solenoid starter *S* and magnet *M* on brake *B* by the wires W_8 and W_9, pulling off the brake *B* and starting the upward travel of the starter arm *H*, thus cutting out the extra armature circuit resistance *R* and bringing the armature *A* to full speed by current passing through the wires W_7, W_8 and W_9. The switches



Matrix Roller Controller Diagram.

S_3 and S_2 are shown as having one blade. This is done for convenience of illustration. Two blades, one for each leg of the circuit, should be used.

As the bed of the matrix roller has about completed its travel it catches the shifter rod *I* and forces it to the right just as it did in shifting the belt, until switch S_3 leaves its jaws *J*, J_1, J_2 and J_3, thereby taking the voltage off the buses L_3 and L_4, thus allowing *H* to drop for a new start and the brake *B* to be applied by the spring *K* and bringing the motor and roller to rest properly.

The operator, if he desires the matrix to pass under the roller a second time, pulls the handle O_1, thereby closing switch S_1 and operating the motor in the reverse direction.

If it is desired to arrange the starter to accelerate the roller to full speed quickly and there is any reason to believe that the commutator might spark with shunt field coils alone, series coils should be placed on the magnets of the motor.

If the matrix roller does work for a large paper and is in use much of the time during the 24 hours, all of the electrical apparatus should be of the very best and well installed. In the rush of getting out plates at the last moment any possible few seconds of delay at the matrix roller would cause much confusion.

A matrix roller that is used for only a few times during the day can be arranged to be operated with a 2-hp or 3-hp motor of the series-wound type. The switches should be fixed to open and close, according to the above plan. The arrangement would be much simpler, however, since only the armature termi-

nals need be reversed. The mechanical brake that was used to stop the roller with shafting drive, in some cases, may be continued in service. This plan dispenses with the automatic starter and electric brake. The motor may spark somewhat at start, thus rendering the arrangement undesirable for constant use.

The electric braking device illustrated is similar to that used in dumbwaiter practice and can be obtained from the motor or controller manufacturers.

Some firms may advise the use of a "dynamic" brake. The use of such a brake necessitates having the field excited when the switch SS_1 is closed, and is apt to consume energy during the whole day, and the excess energy will cost more than a brake in the course of a year.

In the plan shown all of the circuits are open when the roller is out of use. This scheme is the only advisable one for this type of apparatus, since, as a rule, it is out of commission much of the time.

SAW TRIMMER.

The saw trimmer requires about 0.5 hp to operate when in use and should be equipped with some device that will automatically disconnect the motor when the operator is through using the saw.

Standard 0.5-hp motors that do not run faster than 1200 r.p.m. or 1400 r.p.m. should accelerate this machine to full speed without the use of a starting box, especially if the motor is of the compound-wound type, without sparking at the commutator.

As the work to be done produces dust the motor should preferably be of the enclosed type. Since the operator stands in about the same place every time he uses this machine a small switch can be closed by placing the foot on a pedal, holding it down until the cut is made; the switch should be of a type that cannot be held partially open to draw an arc and destroy the switch blades.

A small switching device made on the order of a tank switch, closed with a pedal and opened with a weight or spring, would answer for this purpose. It could be placed under the saw table in a box where it would be convenient for wiring and connecting to the pedal. The open devices that are sometimes used for this purpose may meet with disfavor from the fire underwriters at some future time. In small print shops, where the machines are assembled so that the foreman can overlook them from one point, a snap or knife switch placed at a convenient point might answer, but if the motor is permitted to make long runs when the saw is not in use the energy consumption will be high in proportion to the work done.

PLATEN-PRINTING PRESS.

For 10 years the job printer has been experimenting with various kinds of platen press drive. Much time could be spent to advantage in considering the matter by the electric motor engineers and salesmen and the prospective buyer. The electric motor salesman should know something of the gas-engine drive for this purpose, as he will meet it in competition.

A reliable method of transmitting the power from the motor to the press is by means of a soft leather belt which is probably the best unless the motor is built as a part of the press.

When the motor is rated at 0.75 hp or less it should have at least a 4-in. driving pulley. For 1.0, 1.50 and 2.0 hp a pulley at least 6 in. in diameter should be used.

The belt ought to run on a cast-iron pulley on the press and not on the flywheel, since in most cases the flywheel is not machined on its outer circumference and is apt to be out of round. A split wood or steel pulley, large in diameter, looks out of place on a press of this kind and produces a windage, when the press is up to maximum speed, that takes an amount of energy that will increase the bills appreciably.

The armature controlling devices used on these presses are makeshifts, or, to express it more properly, they are an outrage on the confiding printer, who is under the impression when he buys an individual motor equipment that he is obtaining a proper press control installation, because when his wants are most urgent he finds that he is mistaken.

When 1 hp is required to accelerate a platen press flywheel to full speed in five seconds, 0.25 hp at the motor pulley will probably drive it for maximum production. The experienced motor salesman, in most cases, will sell a 0.5-hp motor and controller for this work, and the buyer thinks he has obtained, say, press-speed control ranging from 900 to 1800 impressions per hour. However, since only 0.5 hp is required to operate the press for maximum production, the quantity of current passing through the controller box is only one-half of what is required for the necessary voltage loss at the controller, hence it absorbs only one-fourth of the energy passing, instead of one-half, when all the armature resistance is in circuit. Now when the presses become limbered up with use and the printer wants to do work that requires a low speed he turns the controller to the low-speed point, but does not get the desired speed. The motor salesman is called, and he advises changing the motor pulley, and thus the printer's troubles begin.

When a 0.25-hp controller is installed with a 0.5-hp motor, that should consume 1 hp at start, the controller will be burned out when a hustling printer gets tired of waiting for the press to accelerate to full speed, and the proprietor will waste time and money getting the equipment into commission again.

A motor of the sizes used for platen presses should withstand a 100-per cent overload in current while the flywheel is accelerating to full speed, allowing five seconds.

It is well to use a motor that will give a press production speed of, say, from 900 to 1800 impressions by field circuit; the motor and armature starting coils in the controller should be designed to take current equal to 100 per cent overload for the motor in accelerating the press to full speed in five seconds. The controller should be so made that when the arm is thrown to the off position the "dynamic" brake stops the press in three seconds. In this case a single idler pulley cannot be used to advantage, since both sections of the belt must do heavy duty, one in starting and the other in stopping the press.

In order to keep the energy consumption low the drive should be so arranged that the motor will stop when the press is out of commission.

Central Station

Management, Policies and Commercial Methods

SIXTY-SIX GASOLINE PLANTS DISPLACED IN DENVER.

During the year 1909 66 gasoline plants were displaced by tungsten-lamp installations connected with the service of the Denver Gas & Electric Company. This is one of the results of the work of the illuminating engineering department under Mr. C. F. Oehlmann. This department goes to the user of gasoline illumination and makes a careful survey of his store. Plans are then drawn up and handsomely executed, showing the location of the store fixtures and furniture, the proposed location of the outlets and the designs of fixtures suggested. Usually alternative designs are submitted; one for the use of Westinghouse Nernst lamps and the other for the use of tungsten lamps with Holophane reflectors of the proper type. The Denver Gas & Electric Company keeps a stock of tungsten lamps and Holophane reflectors, although it does not do any other electric contracting and supply business, except in small elec-

tric heating appliances. The success of the Denver company in meeting gasoline competition with tungsten lamps should be a strong object lesson to other central-station companies which are complaining of this competition.

LONDON CENTRAL-STATION PUBLICITY SCHEME.

The Associated Municipal Electrical Engineers of Greater London have brought before the borough councils a proposal to constitute a publicity committee of municipal undertakings and London companies. It is proposed that this committee shall comprise seven or eight officials of municipal undertakings and the like number of officials from London companies, the work to consist largely in the preparation, printing and publication of publicity productions of common interest, such as leaflets, cards and posters suitable for general distribution.

The association points out that the constitution of a publicity committee, supported by the whole of the electrical supply authorities in the London district, would place that body in a position to engage thoroughly competent people experienced in producing the necessary designs and literature, and that the carrying out of the work on an extensive scale would enable effective publicity to be obtained at a relatively small cost. A guarantee by the various undertakings of $5,000 for the first year is sought.

The view is held by those responsible for the scheme that suppliers of electricity in London are at last waking up to the fact that their business cannot be developed properly without the adoption of proper publicity methods. "Managers of electricity works," said a gentleman who is taking part in the organization, "appear to be realizing the complete ignorance of the general public on matters affecting the uses of electricity. The prolonged fight for the control of electric supply in London brought together the managers of both the companies and municipal undertakings, and they have come to recognize that their interests are, in a great many respects, identical, especially regarding the development of business.

"The results achieved by electric supply works under municipal control have been fairly satisfactory, and can undoubtedly be made much more so. A large amount of educational work is necessary to bring home to householders and factory proprietors the great benefits to be gained by availing themselves of the manifold uses of this modern agent. Those responsible for the control of electricity supply works would do well to learn from their competitors, the gas companies, the advantages of handling their businesses in a more broad-minded and progressive spirit, as contrasted with the stifling attitude of many Moderate members. If the organization succeeds in its aim," he concluded, "there is no doubt its scope will have to be very considerably expanded, and in all probability either by expansion or imitation will extend its influence throughout the country."

COURT CONSTRUCTION OF ELECTRIC LIGHTING FRANCHISE.

In 1884 the Omaha City Council passed an ordinance which gave to the New Omaha Thomson-Houston Electric Light Company the right to erect and maintain poles and wires, with all the appurtenances thereto, upon or over the streets, alleys and public grounds of Omaha "for the purpose of transacting a general electric light business" under such reasonable rules and regulations as might be provided by ordinance. The provisions of the ordinance were accepted by the New Omaha Thomson-Houston Electric Light Company, and an electric light plant established in the city of Omaha, the electrical current therefor being transmitted over wires strung upon poles erected upon the various streets and alleys within the city. The application of electric power to stationary machinery was not well understood or developed in 1884, and for several years thereafter, but as appliances were invented for such purposes, they were used by said electric light company. It was held that the city was not estopped from asserting that the company had no right to use the streets for the transmission of current for purposes other than lighting, because, with knowledge that the company was so using them, it passed general ordinances regulating such use, nor because, under an ordinance imposing a gross-earnings tax on all companies furnishing electricity for lighting, heating and power purposes, it accepted taxes from such company based on its income from electricity furnished for power as well as lighting purposes.

It was said in the course of the court's opinion: "The evidence shows, as before stated, that at the time the City Council acted in 1884 the application of electric power to stationary machinery was not well understood or developed, and was not for several years thereafter. I cannot think that, in granting in 1884 the right to transmit electricity through the streets and alleys of the city for general electric lighting purposes, it was in the mind of the City Council, or any of the parties, or that they for a moment contemplated or intended that the ordinance in question granted the right to transmit an electric current for all purposes and uses to which the inventive mind might in the future apply it, even though such new uses might be equally beneficial to the public. Had such been the intention, the word 'light' would have been omitted. The words 'a general electric light business,' as used in the ordinance, shows clearly an intention to limit the use to which the electric current was to be applied." Omaha Electric Light & Power Company vs. City of Omaha, United States Circuit Court, 172 Fed. Rep., 494.

EFFECT OF TUNGSTEN LAMP INTRODUCTION IN QUINCY, MASS.

At a recent hearing before the Massachusetts Gas and Electric Light Commission Mr. H. M. Faxon, treasurer of the Quincy Electric Light & Power Company, gave an interesting résumé of the experience of his plant with the tungsten lamp during the past eight months. Last spring the company adopted the policy of introducing to its consumers the tungsten lamp, one unit of 40 watts being installed free of charge in the residence of each consumer, the total number distributed being 1384. About five weeks were required to complete the work.

In July, 1908, with carbon lamps, the total number of meter readings taken in the month was 1279 and the total gross receipts from commercial lighting were $4,269. In July, 1909, there were 1455 meter readings taken and $4,274 received. The average gross bill for July, 1908, was $3.33, and for July, 1909, with the tungsten lamp entering the residence field, $2.93. Nearly 200 more customers were on the lines in 1909. The lighting rate remained the same, while the average bill per customer decreased by 12 per cent. In August there was a reduction of 15 per cent on the average bill, in September 17 per cent, in October 5 per cent, in November 12 per cent, and in December 3 per cent. The average gross bill for December was $5.60, including all the store lighting. Among 1581 customers in December, 1909, there were 165 consumers whose gross bills amounted to $10 or over. The 165 bills amounted to $3,874, the remaining 1416 totaling $4,992. The average per bill for the 165 customers was $19.96 net, and the average of the rest was $2.99 net, after deducting the usual discount.

A specific instance of the effect of the tungsten lamp was cited in connection with a drug store having regular hours for opening and closing daily, so that the hours of burning are about the same from year to year. There are 12 outlets. On Dec. 23, 1908, the installation consisted of 100-watt Gem lamps, which were then replaced by 60-watt tungstens, with the result that the service was greatly improved and the bills for the year reduced by 27 per cent. In store lighting the company's policy is to install free the first outfit of tungsten lamps, giving also shades and holders. Mr. Faxon stated that within the past year 556 100-watt, 807 60-watt and 602 40-watt tungsten lamps had been installed free by the company. It has been the policy of the company to eliminate losses, and this has been done by the tungsten filament. During the year the drug store mentioned had had a total of 12 renewals at a cost of $11.60. The consumer is charged for renewals on account of the fragility

of the filament. Carbon lamps are renewed free. Mr. Faxon said that the druggist had saved about 2 watts per candle-power over the carbon filament, 27 per cent on his bills, and had enjoyed far better service. While the receipts for the past six months from lighting have decreased, the number of consumers has increased by some 150 and the management feels that the company is benefited through the increased satisfaction and decreased price.

AN ENGLISH SOLUTION OF THE CONTRACTOR vs. CENTRAL-STATION SITUATION.

According to our English contemporary, *Electrical Industries*, a solution has been found at Brighton to the contractor vs. central-station situation. A plan has been drawn up whereby the wiring and fitting of houses and other premises will be done upon a mutual hire-purchase agreement between the contractors and the owner and tenant of the premises. In a report on the scheme the borough engineer points out that it is the contractor's intention to develop a business among small properties, enabling the tenant to enjoy the advantages of electric light without having to lay out a considerable amount of capital in the first instance, the installation eventually becoming the property of the owner. The suggestion is that the contractor shall provide all the wiring and fixtures, free of expense, risk or responsibility, so far as the central station is concerned, the consumer being supplied through a prepayment meter at 2 cents per kw-hour above the ordinary lighting rate, the extra amount being paid over to the contractor for the installation, and when the consumption reaches 240 kw-hours per outlet installed, the fixtures become the property of the owner of the premises. The scheme will be open to all wiring contractors who care to embark their capital in such a venture.

Mr. Christie, the borough engineer, points out that if the suggestion be carried into effect, the extra cent per kw-hour now charged for meter rental to prepayment consumers would have to be abolished, but, as a rule, they are fairly long-hour users and as there is no risk of bad debts, an average price of 8 cents per kw-hour will afford a reasonable revenue for this class of business. He sees no serious objections to the scheme, and considers it gives opportunities for extending the use of electric light among a class of consumers who, in the ordinary way, will never be gotten in touch with owing to his inability to pay the first cost of the installation in one lump sum. Among the conditions are that in case of a change of tenancy the units already consumed still count toward the purchase price; arrangements to be made to free such installation at any time by a cash payment, the amount of such payment being based upon the records and determined by the central station in conjunction with the contractor; existing installations can be taken over on this system at arranged terms; arc-lamp installations can be fitted on same lines, the purchase consumption for two miniature arc lamps complete fitted being 2400 kw-hours, or for two 5-amp standard pattern 3000 kw-hours, carbons and trimming extra. The system can also be adapted to heating and power circuits by arrangement.

The Brighton Electricity Committee is of opinion that the proposal is a practical one, and would be of considerable advantage to the corporation in enabling a supply of electricity to small properties in cases where the owners or occupiers are not in a position or are not prepared to meet the initial cost of wiring and fitting the premises. With regard to the proposed abolition of the charge of 1 cent per kw-hour at present charged in lieu of meter rent to consumers supplied through prepayment meters, the committee is informed by the engineer that the revenue at present received from this source amounts to about $200 per annum. It is advised by the town clerk that it cannot charge customers under the new scheme a less rate for their electricity than that which is paid by customers taking a supply by prepayment under the existing tariff, namely, 9 cents per kw-hour. The committee is of opinion, however, that the advantages to be derived from the present scheme are sufficient to justify the abolition of the charge of 1 cent referred to, and recommends that for the future the charge for the supply of electricity by prepayment meter be 8 cents in lieu of 9 cents. It also recommended that the Council approve of the above conditions, and offers to wiring contractors in the borough who will undertake the wiring and fitting of premises on those terms, to collect on their behalf and to pay over to such contractors the sum of 2 cents per kw-hour received by the corporation over and above the sum of 8 cents per kw-hour consumed by the tenant of the premises in which electric wiring has been installed or fittings supplied in accordance with the terms of the agreement.

INCREASE IN CENTRAL-STATION SERVICE AT WORCESTER, MASS.

Within the past three or four months the electric motor-service business of the Worcester Electric Light Company has shown a gratifying increase, and since Oct. 1 over 500 hp in connected motor load has been added to the system. The number of motor customers has increased from 406 to 437, and a sales engineer is actively at work canvassing the Worcester market. Practically all of the new motor load secured is supplied at 2300 volts over three-phase distribution circuits carried in underground conduits. The new installations include foundries, machine-screw makers, knitting mills, corset shops and miscellaneous manufactories, the largest installation having a rating of 182 hp. All of the installations are of the group-driven type where more than one machine is in service. To facilitate the introduction of electric service the company makes careful engineering studies of each installation, and where necessary makes readings of the power requirements, locates motor positions, advises regarding shaft speeds and belt changes. The new motor-service business is already producing an improvement in the load curve of the plant, tending to create a higher average output during the day than previouly obtained.

The schedule of motor-service rates which went into effect in the fall has been well received. These start with a base rate of 6 cents per kw-hour, running down to a minimum of 2 cents according to the consumption, the minimum monthly charge being $1 per horse-power. The company has no water-power facilities, although under the agreement which it recently made with the Connecticut River Transmission Company it has entered into a relation which permits a joint use of distributing circuits. The Gas and Electric Light Commission has limited the latter company to the large motor-service market in Worcester, and service has just been inaugurated between the Vernon plant on the Connecticut River and the Worcester works of the American Steel & Wire Company, both at the north and the south ends of the city.

In the fields of window and sign lighting the Worcester company is making continued progress, and Main Street, the principal business thoroughfare of the city, presents an appearance considerably changed in comparison with the situation a few years ago. Many retail houses are now operating window installations during the early evening hours, and in several instances flaming-arc lamps have been installed at prominent street-corner establishments. Special attention is being given in the window installations to the use of reflectors for keeping the light out of the eyes of passers-by. The larger sizes of tungsten lamps have been widely introduced in mercantile houses, notably in the higher class of news stands and in soda-fountain work. Small motors have come into extensive use in markets of even moderate size, and long hours of burning both arc and incandescent lamps are in evidence in grocery and provision houses.

The larger industrial plants of the city are gradually installing electric signs, particularly in the cases of organizations making products of more than local interest and located within sight of the railroad trunk lines passing through the city. In connection with the construction of the new Union Station at Washington Square by the New York Central Lines many flaming-arc lamps have been installed to facilitate the demolition of the old structure and the movement of passengers to

and from the streets. Temporary installations of incandescent lamps have also been connected for service in the waiting-rooms and news stand. In the latter case the commercial values of the situation have been greatly increased by the installation of a line of 28 16-cp lamps placed on a horizontal axis in a reflector located in front of a magazine rack 30 ft. long, the reflector being about 9 ft. above the floor and the rack 6 ft. in height from the table to the ceiling.

During the Christmas season the company's output was the largest in its history, the peak load passing 3000 kw. In connection with the new plant projected at Curtis Pond, the company has practically reached the conclusion that the initial equipment will be from 7000 kw to 8000 kw. The existing station is rated at about 4500 kw. The new plant will probably be of the steam-turbine type, with greatly improved condensing and coal-handling facilities.

Wiring and Illumination

BILL BOARD LIGHTING IN DENVER.

During the last two months of 1909 the Denver Gas & Electric Company closed enough contracts for electrically lighting billboards to yield $2,000 per year gross revenue. All these contracts were taken for lighting with 100-watt tungsten lamps with sheet-iron, scoop-shaped reflectors. The entire billboard lighting is done at a flat rate of so much per year and is turned on or off by the company's patrolmen at hours specified in the contract, just as is the sign and outline lighting, of which this company has a great quantity. The flat rate given is the equivalent of the regular Doherty readiness-to-serve rate—that is, the amount which would be consumed by a sign or billboard installation is computed according to the number of hours' use per year and the connected load. This amount is the flat rate named in the contract. The readiness-to-serve rate consists of a fixed charge per year for each connected lamp and a kw-hour charge for the amount of energy consumed, these two amounts being added together to make the total rate. This billboard lighting is coming to be an important part of the Denver company's flat-rate load.

THE CALCULATION OF VOLTAGES FOR A SPECIAL ARRANGEMENT OF INCANDESCENT LAMPS.

By Roscoe Scott.

A somewhat peculiar problem in incandescent lamp engineering was recently encountered, the general solution of which may be of interest. The conditions giving rise to the problem were the following:

A certain street railway, operating its cars at a nominal e.m.f. of 630 volts, desired to replace its carbon lamp equipment as far as possible by a tantalum equipment. Each passenger car contained a special circuit like that shown in Fig. 1, consisting of a group of five lamps connected in series with a multiple group of two lamps, all seven being 115-volt carbon lamps of the same rated candle-power. The two multiple lamps, operating on half normal current, gave a dim light of about ⅓ cp each, and were used to illuminate certain gages, for which purpose this intensity was ample. The questions which presented themselves in connection with the transfer to tantalum illumination were the following:

(1) If tantalum lamps of the same rated candle-power as the carbon are used, will the dim lamps still give enough light on the gages? (2) For what voltage must all seven lamps be ordered, that the five series lamps may operate at their rated specific consumption?

The first of these questions was answered in the affirmative, after the simple test of running a tantalum lamp on half-current had been tried. The second question was less simple.

It so happens that the resistance of the ordinary treated carbon filament is nearly constant for a range of current from normal down to 50 per cent, so that for practical purposes the drop across the parallel group was one-half that across each

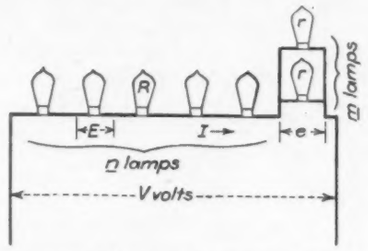


Fig. 1—General and Special Arrangement of Lamps.

of the five bright lamps—the total drop, 630 volts, being five and one-half times this latter value. The carbon lamps for these special circuits were, therefore, ordered for 115 volts ($630 \div 5.5 = 114.6$). The resistance of the tantalum filament, however, is far from constant over the percentage range of current in question.

Fortunately, the relation between terminal voltage and current for commercial filaments follows to a sufficiently close approximation an exponential law, and the exponent for each

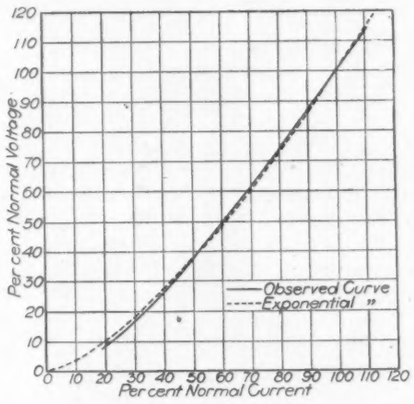


Fig. 2—Voltage-Current Characteristic of Tantalum Lamps.

class of filament (treated-carbon, metallized-carbon, tantalum, tungsten) has been experimentally determined. Thus, for a treated-carbon filament:

$$E = KI^{0.284}$$

For a tantalum filament, rated at 2 watts per candle,

$$E = KI^{1.425},$$

K being constant for any individual lamp.

In Fig. 2 are plotted the actual voltage-current characteristic curve for tantalum lamps rated at 2.0 watts per candle, and also (dotted) the 1.425 exponential curve; the agreement is seen to be close.

GENERAL CASE.

In Fig. 1 let

$n + m$ = total number of lamps, all made to same specifications.

E = potential across any one of the n series lamps, in volts.

e = potential across the m parallel lamps, in volts.

V = potential across the entire combination of lamps, in volts.

Let the relation between terminal volts and amperes for the particular class of filament of which the lamps are made be expressed by the general equation:

$$\frac{E_1}{E_2} = \left(\frac{I_1}{I_2}\right)^a$$

where a is an exponent whose value is known in the numerical case.

to be arranged in groups of four each, in order to utilize the line pressure to its full advantage, while in some cases only two lamps were required for store-window lighting.

This difficulty has so far been overcome by connecting two flame-arc lamps and two ordinary arc lamps in series, and installing the flame-arc lamps outside in front of the window,

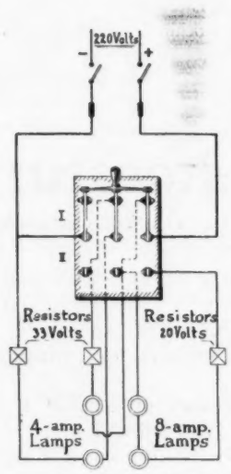


Fig. 1—Diagram of Connections.

Fig. 2—Excello Lamp.

whereas the ordinary lamps were reserved for inside lighting. However, this arrangement cannot always be chosen, since it is not in all cases desirable to have the large lamps inside the stores or to burn four lamps at the same time. In fact, there are many cases where light is wanted only in the store and not outside, for instance, when dusk sets in or after closing hour.

Messrs. Körting & Mathiesen, Limited, of Leutzsch, near Leipsig, have designed a new economical arrangement of connections which affords a very satisfactory solution of the problem. As represented in Fig. 1, the two types of lamp which are most suitable for indoor and show-window lighting, re-

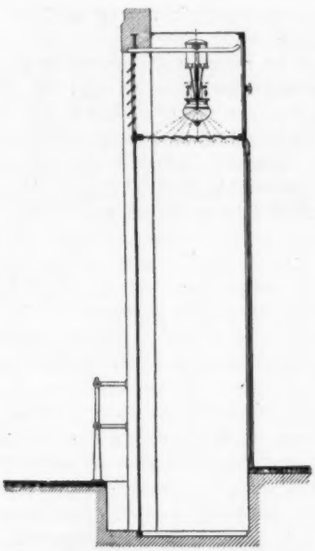


Fig. 3—Ideal Arrangement for Shop-Window Lighting. Fig. 4—Long-Burning Lamp for Direct Light.

spectively, are combined in such a manner as to be used independently of each other, according to requirements. The store lamps can, therefore, be switched on separately, the window lamps being added later if necessary.

The arrangement is primarily intended for 220-volt continuous-current circuits. Two flame arcs of the Excello type are used for window lighting, and two long-burning lamps are installed in the store. A combination can thus be effected, for example, of two 8-amp Excello lamps with two 4-amp long-burning lamps or two 10-amp Excello lamps can be combined with two 5-amp long-burning lamps. The arrangement allows the two long-burning lamps to be worked alone at the beginning in series at 220 volts, the e.m.f. being fully utilized; while it is quite as feasible to use all four lamps at the same time, the two long-burning lamps being arranged in parallel, while the two Excello lamps are arranged in series, the two sets being inserted in series in a 220-volt circuit. The consumption with the two long-burning lamps alone is $4 \times 220 = 880$ watts, and with four lamps in series is $8 \times 220 = 1760$ watts. In neither case is there any useless expenditure of energy in resistors.

Another reason for choosing this arrangement is that flame-arc lamps doubtless rank among the very best and cheapest of show-window lamps. Inclusive of losses in the series resistors the specific consumption of each lamp is, in fact, only about one-fifth watt per candle. Again, it is most adaptable to existing conditions, its light being yellow for windows displaying leather goods, bags, boots, etc., while for porcelain and hosiery stores a white, and for butcher shops a red shade can be chosen. The lamp can be hung in front of the window, where it is more attractive than any other lamp, owing to its enormous luminous intensity (about 3000 cp) and its beautiful radiating glow. It can, however, be installed inside the show window above the goods displayed and behind a glass partition so that the lamp itself is out of sight, although the show window is brilliantly illuminated. The latter is obviously the most desirable method of lighting show windows (see Fig. 3).

Fig. 5—Long-Burning Lamp for Semi-Indirect Light

On the other hand, the long-burning lamp (Figs. 4 and 5) is a most suitable type for indoor lighting. The first cost of the lamp is low; its size is small and convenient, and little superintendence is required, as one set of electrodes will last from 25 hours to 30 hours. The electrodes burn away very slowly, involving a cost of only about 40 cents in 1000 hours. The remainder of the top electrode can be used as a bottom electrode. The specific power consumption is from 0.5 watt to 1.0 watt per candle-power, according to the current rating and fittings. The globe is most attractive, and the light of a pure white color. A large variety of fittings for direct and semi-indirect lighting have, therefore, been brought out of late years to meet all possible conditions.

As the specific power consumption of these lamps is only about half that of metal-filament lamps, while the cost of electrodes and maintenance does not exceed 20 per cent of that for the renewal of metal-filament lamps, the long-burning arc lamp is materially cheaper in practice than the metal-filament incandescent lamp. The arrangement described above thus combines the two types of lamp most suitable for the lighting of windows and interiors, respectively.

Call the current taken by each n lamp, operating under the stated conditions, I, and that taken by each m lamp, i.

Then,

$$\frac{E}{e} = \left(\frac{I}{i}\right)^a. \qquad \text{But } \frac{I}{i} = m.$$

Whence,

$$\frac{E}{e} = m^a. \qquad \text{Or } e = \frac{E}{m^a} \tag{1}$$

Adding up the potentials of the circuit,

$$nE + e = V \tag{2}$$

Substituting (1) in (2),

$$nE + \frac{E}{m^a} = V.$$

Or,

$$E = \frac{V}{n + \frac{1}{m^a}} \tag{3}$$

SPECIAL CASE.

For two parallel lamps, five series lamps, and a car voltage of 630, there will be for carbon filaments, from equation (3):

$$E = \frac{630}{5 + \frac{1}{2^{0.864}}} = 114.4 \text{ volts.}$$

For tantalum filaments:

$$E = \frac{630}{5 + \frac{1}{2^{1.425}}} = 117.3 \text{ volts.}$$

Owing to the marked difference between the voltage-current characteristics of tantalum and treated carbon, the bright tantalum lamps will, as just shown, operate at a potential 2.9 volts higher than that at which the bright carbon lamps operate. The tantalum lamps should therefore be ordered for 117 volts, "selected for series burning." Thus, 117 is the answer to the second of the two questions which presented themselves in connection with the transfer from carbon to tantalum illumination.

TUNGSTEN STREET ARCHES AT HOBART, OKLA.

By G. E. Miles.

Articles have appeared from time to time in the *Electrical World* descriptive of tungsten arches at various places, but as the

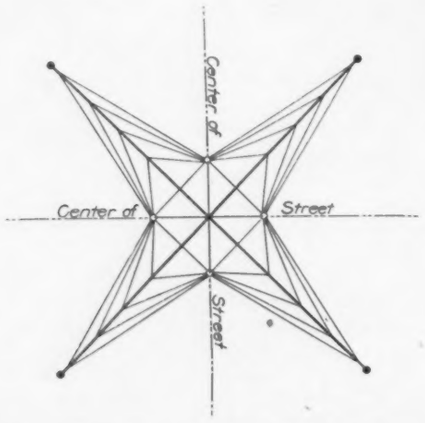


Fig. 1—Method of Guying and Supporting.

arches constructed by the writer at Hobart, Okla., last summer are radically different from any that have been described, an account of them may not lack interest.

It was desired to place five arches at as many street intersections, and as there were no tall buildings on several of the corners to which supporting cables could be attached, and as the placing of poles on these corners was to be avoided, it was decided to attempt to make the arches self-supporting.

The arches were constructed of 1¼-in. iron conduit, the sec-

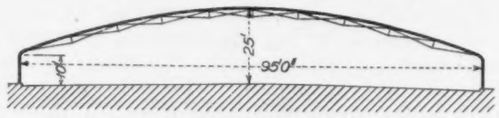


Fig. 2—Diagram of Arch.

tions being connected together by regular pipe fittings. The manner of guying adopted to make the structure rigid and self-supporting is shown in Fig. 1, and the daylight photograph, in Fig. 2, shows one of the completed arches. The posts supporting the arches comprise sections of 3-in. iron pipe set in concrete and extending 10 ft. above the walk. The tops of these

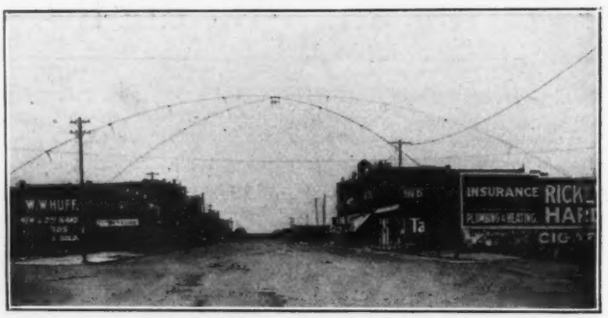


Fig. 3—General View of Street Arch.

posts are reduced to 1½ in. in size, forming sockets into which the feet of the arches are set. The arches can be lifted bodily out of these sockets and lowered to the ground. Each arch has one 100-watt lamp at the intersection of the four legs, and 80 5-watt, 12-volt lamps, spaced 2½ ft. apart, on the legs. The entire arch thus takes 500 watts. It is now realized that this does not give light enough, and it is the writer's opinion that lamps totaling not less than 1000 watts should be used on such

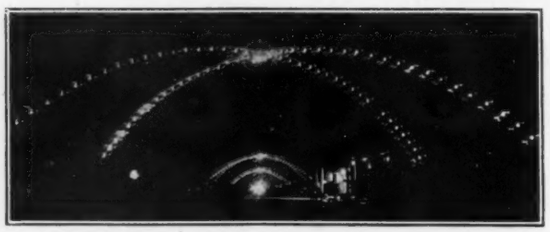


Fig. 4—Illuminated Arches.

an arch. In the present case, however, it was desired to have the arches operated at the same cost as that of the arcs, which they displaced.

The posts were filled with concrete to within about 18 in. of the top, and though the feet of the arches extend down into these posts about 1 ft., water accumulated in one of them in December, and by freezing and thawing, lifted the arch out of the posts and let it fall. Holes were then drilled in the posts to let the water out, thus avoiding a second occurrence of the kind.

AN ECONOMICAL ARRANGEMENT FOR STORE-LIGHTING.

Owing to its high luminous intensity and remarkable efficiency, the flame-arc lamp has been applied on a large scale to the lighting of show windows. This type of lamp will normally operate with two in series at 110 volts or four in series at 220 volts, so that in continuous-current, 220-volt circuits a difficulty has always been encountered, the more so as the lamps had

broadly, moisture and impurities, the former may be tested by placing some of the oil in a small vessel, and plunging into it a piece of iron which has been brought up to a dull red heat. A sharp hissing noise will occur if there is much moisture in the oil, while a dry oil will cause practically no such hissing. Another simple test is to pour a little of the oil on some anhydrous copper sulphate, when, after having been shaken well in any suitable vessel, the copper sulphate will turn a bluish color if there is moisture present. As regards testing for impurities, the presence of any acids or alkalis may be detected with litmus paper. Any solid impurities, such as dirt, carbon deposit, etc., may be seen by running a little of the oil slowly out of a glass bottle, the bottle being held to a good light. An oil showing such particles should be rejected at once, though very often it would be quite sound for all practical purposes after careful filtration. The best oil for insulating purposes is a mineral oil, and it seems that there is very little difference between heavy and light oils. The curve giving the relation between the gap length and the breakdown pressure is approximately a straight line. In average good transformer oil, when sent out by the makers, a 1-in. gap will break down with somewhere between 70,000 volts and 100,000 volts with plate contacts, or somewhere between 45,000 volts and 60,000 volts with needles. To ensure obtaining a pure oil, the natural oil should be subjected to fractional distillation, and dried and sealed without chemical treatment of any kind. For drying, the author proposes baking in an oven rather than dehydrating with metallic sodium.—Lond. *Elec. Eng'ing,* Dec. 30.

Lamps and Lighting.

Daylight Efficiency.—H. E. IVES.—An article on daylight efficiency of artificial illuminants. The author gives two different definitions of this efficiency. The first of these is the white light efficiency, which is obtained by consideration of the white light available by the use of absorbing screens. The white light is non-selective white light, spectrally identical with Nichol's "average daylight." The term "white-light efficiency" is applied to the ratio of the intensity of non-selective white light available to the intensity of the source. Its numerical value depends on the point of the spectrum at which absorption starts, and is zero for a bright-line source. It is of practical importance as an indication of the loss in efficiency to be expected by producing "daylight" by the use of colored globes on artificial sources. As the white light obtained is identical with daylight, the "white-light efficiency" is a good indication of a source's excellence for use where color discrimination is necessary. The larger the proportion of available white light the nearer will colors appear in their daylight values. Fig. 1 illustrates the excesses of colored light in various light sources represented in terms of luminosity. The shaded area represents the spectrum of white light expressed in terms of luminosity; it is, in other words, the sensibility curve of the normal eye referred to white light. The areas of the outlined curves are therefore proportional to the intensity of the unscreened sources, the shaded area to the intensity of the white light remaining after screening. Curve 1 refers to a carbon-filament lamp consuming 4.85 watts per mean spherical candle-power; curve 2 to a carbon-filament lamp consuming 3.75 watts per mean spherical candle-power; curve 3 to a metallized carbon-filament lamp consuming 3.1 watts per candle-power; curve 4 to a tantalum lamp, 2.6 watts per candle-power; curve 5 to a tungsten lamp, 1.56 watts per candle-power; curve 6 to an acetylene lamp; and curve 7 to a Welsbach gas mantle, ¾ per cent cerium. The second definition of daylight efficiency gives the white sensation efficiency which is obtained by consideration of the amount of white which with a spectrum color would match the light. The term is applied to the ratio of the intensity of white sensation to the intensity of the source. The method is independent of any arbitrary screening point, and is applicable to all types of sources. The white sensation obtained indicates the color of the light or of a white surface illuminated by it. It gives no indication of the suitability of a source for color discrimination. The white sensation is larger than the white light given by the first method, and is as a rule only partly or not at all available as non-selective white light.—*Bull. Bureau of Standards,* Vol. 6, No. 2, November, 1909.

Photometer.—In a description of apparatus exhibited at the recent exposition of the London Physical Society a new photometer bench suitable for laboratory and central-station use is mentioned. The chief point of novelty is in the photometer head itself, since the adjustment of illumination is made by

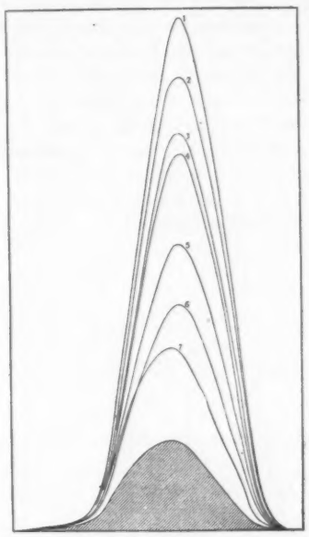


Fig. 1—Daylight Efficiency Curves.

altering the angle of incidence of light on one of the two screens. The advantage of this is that instead of it being necessary to move a heavy carriage with a standard lamp, etc., both lamps can be fixed and the entire adjustment made on the photometer head itself. A sectional view of the head is given in Fig. 2. The arrangement should prove particularly useful when dealing with flame standards, whether of gas or pentane, etc. It is also much easier to obtain a balance by this means than with the comparatively slowly moving lamp carriage. A further advantage possessed by this arrangement is that it affords a ready means of reducing the illumination from one of the lamps so that it is easy to test high candle-power lamps, such as arcs in a comparatively small photometer room. It

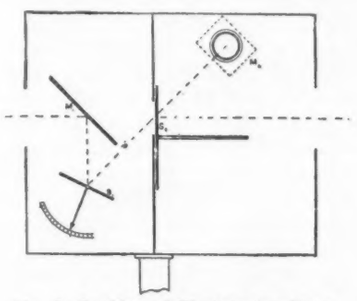


Fig. 2—Section of Photometer Head.

also affords a rapid means of comparing a number of almost similar lamps where it is merely desired to know by what percentage their light is above or below a given value. The rays of light strike the screen at right angles so that angularity errors are entirely avoided.—Lond. *Electrician,* Dec. 31.

Height of Lamps in Streets.—J. SUMEC.—The height at which lamps should be suspended above the street depends on the quality of illumination desired, the price of the lamp poles, and the ease of attendance. The author shows that in order to get a good horizontal illumination, electric lamps, as well as

Letter to the Editor.

Patent Office Reform.

To the Editor of Electrical World:

Sir:—I have read with deep interest the recent correspondence in your columns relating to patent reform, especially the letter by a former chief clerk and principal examiner in electricity of the U. S. Patent Office. I fully agree with the opinion therein expressed that the Patent Office should be taken from the Department of the Interior. This department will always be a Department of the Exterior to the inventor. The system of mixing the interests of the most creative and dynamic class in society with the Indian Bureau, which is necessarily governed in a restrictive spirit, and with the Land Office, which has always been a hot bed of land frauds, is without justification and is altogether opposed to all constructive ideals. The writer also submitted without avail to President Roosevelt a criticism of the present patent system, and suggested the creation of a new department of the Government somewhat similar to those abroad which have cognizance of the intellectual movement of human society, this to include the Library of Congress, Patent Office, Smithsonian Institution and other bureaus, some old and some to be created.

Washington, D. C. Joseph J. O'Brien.

Digest of Current Electrical Literature

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Construction of Dynamos and Transformers.—L. Fleischmann.—A review of the present conditions of dynamo and transformer construction and design. No new principles have been evolved in the last years, but with respect to details of construction, much progress has been made. On account of the increased use of steam turbines, there is a tendency to increase the speed of electric generators. At the same time, there is a tendency to increase the rating of generators, so that machines of 20,000 hp will soon be in operation. Such ratings can be obtained only with polyphase alternators. The difficulties in the construction of such machines increase with the output per pole and are due first to the difficulty of safely placing the required field copper, and secondly to the necessity of producing a sufficient cooling effect by artificial means. In single-phase generators for high outputs per pole, as they are now being built for traction purposes and for electric steel furnaces, the pole shoes get heated to a considerable degree, due to the pulsating armature reaction. To reduce this heat effect the poles and pole shoes are laminated and are provided with a short-circuited damping coil of as low an ohmic resistance as possible. On account of the increased use of large gas engines, low-speed flywheel generators are being built for direct coupling with gas engines, in continuously increasing size; the largest size now in use has a rating of 3000 hp. For transmission plants generators are now sometimes built to produce directly the e.m.f. required for transmission, say, up to 30,000 volts. However, there are many reasons why the voltage of the machines should not be made higher than, say, 15,000 volts. Important progress is represented by the commutator alternating-current motor. The use of special steels containing silicon has been found very advantageous for transformer construction; it has proved uneconomical for generators with the exception of a few special cases. In transformers, special alloy steel permits an increase of the efficiency and a reduction of the weight for the same rating. This has also led to an increase in the output rating of transformers. Considerable progress has also been made in the artificial cooling of transformers. For the purpose of voltage regulation the use of potential regulators is increasing; by the use of special alloy steel in their construction their weight can also be decreased considerably for a given rating. The most important progress in direct-current dynamo design is the more general use of interpoles and compensating windings. The increase of the voltage of direct-current railways has caused the construction of direct-current generators for higher voltage than heretofore. Direct-current machines provided with interpoles are now in use for 1200 volts. It is expected that machines for 2000 volts will soon be constructed. Progress has been made in the material and the methods of manufacture of carbon brushes. Further progress in dynamo and transformer construction in the near future seems to depend on an improvement of materials. For instance, if alloy steels could be obtained cheaper than heretofore and with an increased permeability of the iron, it would be possible to make an additional increase in the rating for a given weight. Another new advantage desired is an insulating material which can withstand higher temperatures than those now used.—*Elek. Zeit.*, Jan. 6.

Frequency Changer.—A description of a new frequency changer invented by Messrs. A. P. Wood and R. S. McLeod. According to existing practice, a frequency changer comprises two alternators, the rotors of which are mechanically coupled together; one of these machines is connected to the mains of the supply system and the other is connected to the mains of the other supply system and to the common system of mains. While the rotors run at the same speed, the frequencies of the machines correspond with the frequencies of the respective system. This arrangement presents difficulties in starting up and synchronizing; as any tendency of either station to depart from its normal frequency has to be prevented by the coupled alternators which link the supplies together, it will be seen that when each of the coupled supply stations has an output which is large as compared with that portion which is supplied to the common mains, the tendency of either to depart from normal frequency can only be resisted by the coupled alternators transmitting a very considerable torque which may exceed that which can be safely transmitted. With this arrangement, the ratio of the frequencies must be maintained exactly at that for which the two supply systems are designed and this in practice is difficult of attainment. In the new system of the inventors two alternators are provided, the rotors of which are mechanically coupled together, but the stator of one of the machines (the "case") is made rotatable about the axis of the rotor, and its rotation is controlled by a geared motor which applies to it a torque varying in sign, but not exceeding a predetermined maximum. Denoting the machine with the rotating case by *A*, and the other by *B*, the speed of the rotors will be that corresponding with the frequency of the supply to which *B* is connected, and if the frequency of the other supply corresponds with this speed and the number of poles of *A*, the case of the latter will remain stationary, and will be held stationary by the case-controlling motor. Should the frequency of either supply change, the effect will be to tend to alter the torque between the case and the rotor of *A*, and as the case motor is arranged to exert an approximately constant torque, the case will rotate in one direction or the other, in accordance with the relative effect of the change of frequency, and by so rotating it will accommodate the frequency changer to the altered ratio of the frequencies. The case-rotating motor may be connected to either supply system, or it may be a direct-current motor, and it would be so connected to resistors as to provide a practically constant torque between its stator and rotor, whether the latter is stationary or not.—Lond. *Elec. Eng'ing*, Dec. 30.

Transformer Oil.—An article on the qualities and testing of transformer oil. The causes of a low dielectric strength being,

incandescent gas lamps, should be suspended at least 5 m (16 ft.) above the street. This is higher than usual practice, since the latter is determined by the lower prices of the poles and the easier attendance of the lamps. The attendance question is of special importance for gas lighting and for this reason gas engineers will hardly adopt the best height to get a good horizontal illumination. It is for the same reason that gas engineers prefer to judge quality of street lighting according to the illumination of vertical surfaces. In view of this fact electrical engineers should emphasize the importance of a good horizontal illumination and the advantage which electric lighting has over gas lighting on account of the greater ease of attendance of electric lamps placed at a proper height.—*Elek. und Masch.* (Vienna), Jan. 2.

Tantalum Lamp.—A note on a recent British patent of the Siemens & Halske Company for the production of pure tantalum. (22,873, 1908; Dec. 23, 1909.) Pure ductile tantalum is produced by reducing a mixture of tantalic acid (or other oxygen compound) and carbon at a white heat in a current of hydrogen. The reduction can be carried out in an electrically heated carbon tube or an electric current can be passed directly through the mixture pressed into rods.—Lond. *Elec. Eng'ing,* Dec. 30.

Metallic-Filament Lamps.—B. Duschnitz.—An article giving brief illustrated descriptions of various methods of mounting the metallic filament in the lamp globe.—*Elek. Anz.,* Dec. 23, 26 and 30.

Generation, Transmission and Distribution.

Energy Transmission System in France.—A description illustrated by a map of the large transmission systems of Southern France. The Société Energie Electrique du Littoral Mediterranean, formed in 1900 for the supply of electricity in the south of France, now obtains energy from seven large hydroelectric stations and nine steam stations with a total generating rating of 56,500 hp and 23,100 hp respectively. These stations are connected together by a number of transmission lines carrying three-phase currents at 50,000 volts and at lower pressures. The alternating current is generated and distributed at two different frequencies, and there are both alternating-current and direct-current systems of distribution.—Lond. *Elec. Eng'ing,* Dec. 30.

Rolling Mills.—C. A. Ablett.—An illustrated description of the Ilgner system as applied to the electric driving of reversing rolling mills.—Lond. *Electrician,* Dec. 31.

Rolling Mills.—W. Schömburg.—An article giving data to show the economy of the electric driving of rolling mills compared with steam power.—*Elek. Zeit.,* Jan. 6.

Steam Turbines.—P. Ehrlich.—The first part of an illustrated lecture on the different systems of steam turbines and turbo-generators.—*Elek. und Masch.* (Vienna), Jan. 2.

Water-Power Plant.—H. P. Kieffer.—A profusely illustrated description of the McCall Ferry water-power plant on the Susquehanna River in Pennsylvania,—Lond. *Eng'ing,* Jan. 7.

Traction.

Brake Blocks.—An account of a report made by E. Wilson for the Tramway and Light Railways Association on the best material for brake blocks. The materials tested were oak and poplar (with the grain horizontal); Frood's lining (two qualities); and soft gray cast iron. The wheel tires were made of chilled steel. Velocities up to 22 miles per hour were dealt with, and specific loadings up to 120 lb. per square inch were employed. Two distinct series of tests were made—one under wet conditions and one under dry conditions. Clean water only was used in the former tests. The enormous superiority of cast iron over non-metal linings, when water or other lubricant is present, is confirmed, the ratio of superiority being of the order of 10 to 1. In every case the coefficient falls with an increase of speed and, with the exception of cast iron, rises with an increased specific load. When tested dry all the coefficients are brought to a higher level than under wet test conditions for the same speeds and loads, and in the case of non-metallic blocks, the differences are enormous, the coefficients being raised even beyond those for cast iron. On the other hand, it is curious to observe that the coefficients of all the materials tested diminish with a rising specific load. Professor Wilson had misgivings as to the general reliability of non-metallic blocks for tramway purposes on account of the effect of water, and if it were not for the fact that road material mixed with water increases the coefficient of friction, he would find it difficult to believe that these substances could be trusted in wet weather for track-brake purposes. Once or twice during the tests upon non-metallic blocks with water lubrication, combined with low temperature, the motors raced with a specific load of 120 lb. per square inch and it is possible that some of the worst runaway accidents have been due in part to this phenomenon.—Lond. *Elec. Review,* Dec. 31.

Comparison of Traction Systems.—O. Tissot.—An article comparing the cost of the various items of different traction systems, especially single-phase and three-phase and in some cases also direct-current traction. While no final conclusion is stated the comparison is chiefly favorable to single-phase traction.—Lond. *Electrician,* Dec. 31.

Single-Phase Traction.—An illustrated description on the introduction of electric traction on the Seetal Railroad from Wildegg to Lucerne in Switzerland, which was formerly operated by steam. Single-phase, alternating current at 5000 volts is supplied to the trolley lines, the frequency being 25. The Deri series motor is employed.—*Elek. Anz.,* Jan. 2.

Installations, Systems and Appliances.

Financial Equations for Central Stations.—L. Crough.—An article with reference to the recent French paper of J. Mathieu. Central-station practice is now so far standardized as to enable certain average assumptions to be made concerning the fixed and running charges per kw-hour. The fundamental equations are given with the empirical figures of Mathieu. The method enables one to solve the following two problems: What is the minimum annual kw-hours that a station of a given total horse-power must sell to be financially stable? What must be the horse-power of a station to produce a given number of kw-hours per year, and what should be the capital engaged in the scheme? Several numerical examples are given.—Lond. *Elec. Review,* Dec. 31.

Electricity on Board Ship.—F. Thilo.—A profusely illustrated description of the electric equipment of the steamer *George Washington,* of the North German Lloyd, on which electricity is employed, not only for lighting, but for a great many different power motors and for electric heating. There is also in use a system of electric transmission of signals.—*Elek. Zeit.,* Jan. 6.

Water-Powers for Electricity Supply in Large Cities.—Norberg-Schulz.—On the basis of statistical data the author investigates the way in which water-powers could be utilized to supply energy for lighting and industrial purposes in large cities. For the economical utilization he recommends combining them with steam plants or storage batteries to provide the peak load.—*Elek. Zeit.,* Jan. 6.

Electrophysics and Magnetism.

Electronic Theory.—W. Sutherland.—A highly theoretical paper on the fundamental constant of atomic vibration and the nature of dielectric capacity. The central cause of the spectrum of an atom is a special pair of electrons situated within the atom on its electric axis. The atom is electrically polarized, because it is formed of constitutive pairs of electrons which have their electric axes similarly directed so as to give the atom electric properties analogous to the magnetic ones of a uniformly magnetized sphere. The internal electric field of the atom corresponds with the external field which produces cohesion. The special electron pair consists of a positive electron which acts as though uniformly distributed through a sphere of radius $R = 0.795 \times 10^{-8}$, which is the same for all atoms. This action may be due to the rapid random motion of a small positive electron through this sphere of constant size.

The negative electron is situated at a distance r along the electric axis of the atom from the center of the sphere. As regards outside action, the positive electron may be supposed altogether at the center of the sphere, so that the special pair of electrons has an electric moment er oppositely directed to that of the whole atom, which is denoted by es. This electric moment es produces the external electric field of cohesion, and it produces the internal field in which the special pair of electrons vibrates. The author shows how it is possible to reach a theory of dielectric capacity by means of the constitutive pairs of electrons and the special pair in the atom. The author's theory strongly confirms the law of molecular attraction, while a very definite conception is obtained of the mechanism which is at the basis of radiation. This is as simple as a pendulum, or a galvanometer needle, or a piano string, but the complex of constitutive pairs of electrons associated with it must be very elaborate.—*Phil. Mag.*, January.

Total Radiation Law.—E. BAUER AND M. MOULIN.—A paper presented before the French Academy of Science on the constant of proportionality in Stefan's law. According to this law the total radiation is $E = sT^4$—that is, it is proportional to the fourth power of temperature T. According to the present authors, the value of s is 6.0×10^{-12} watt per square centimeter and degree Centigrade. This value is believed to be correct within 1 per cent.—*L'Industrie Elec.*, Jan. 10.

Electrochemistry and Batteries.

Regulation of Electric Furnaces.—L. KOLLOWRAT.—A description of a simple method of automatically keeping the temperature in a small laboratory furnace constant over a long period. The temperature is measured by a thermo-electric pyrometer. When the temperature reaches a certain point, the rays from a lamp are deflected by means of mirrors carried by the galvanometer needle onto the junction of a thermo-electric cell and the current generated in the latter operates on a system of relays which switch resistances in and out so as to keep the temperature of the furnace constant.—Lond. *Electrician*, Dec. 31.

Resistor Elements for Heating Apparatus.—A note on a recent British patent of the British Thomson-Houston Company (General Electric Company of this country) for resistors in electric heating apparatus. (26,826, 1908; Dec. 23, 1909.) These are made from an alloy of tellurium and silicon, which has a higher resistance than silicon alone. With 5 per cent tellurium the resistance is from three to five times that of silicon, and the alloy is not brittle; from 1 per cent to 15 per cent of tellurium is employed.—Lond. *Elec. Eng'ing*, Dec. 30.

Units, Measurements and Instruments.

Measurement of High Electrostatic Tension.—M. DIECKMANN.—A description of a simple method for measuring high electrostatic tensions (for instance, in the upper layers of the atmosphere) and for the comparison of capacities. The arrangement is shown in Fig. 3, where the high voltage to be measured

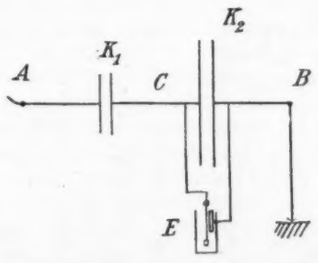


Fig. 3—Arrangement of Condensers, Etc.

is that between the points A and B. For simplicity's sake it is assumed that point B is earthed. Two condensers of known capacities, K_1 and K_2, are connected in series between A and B. K_2 is the larger capacity of the two. It is shunted by means of a calibrated Lutz-Edelmann string electrometer E. If V_1 is the tension between A and earth and if V_2 is the tension between C and earth there is the relation: $V_1 = (K_1 + K_2)V_2/K_1$. The voltage V_2 is measured by means of the string galvanometer. The same method may also be used for the comparison of capacities. In this case a high-voltage battery is employed to produce the tension V_1.—*Phys. Zeit.*, Jan. 1.

Recording Voltmeters and Ammeters in Practical Use.—E. RÜHLE.—An article illustrated by records obtained by recording voltmeters and ammeters. It is shown that they can be used to good advantage for the control of the operation of a plant, for the detection of periodically occurring disturbances, for the establishment of the maximum current consumption of consumers, for the detection of unsuitable conditions in consumers' premises, etc. Comparative load curves show the greater or smaller desirability of different classes of consumers for a central station. It is recommended that others should also communicate their experience with recording instruments.—*Elek. Zeit.*, Jan. 6.

Telegraphy, Telephony and Signals.

Telephone Intelligibility.—G. A. CAMPBELL.—An article with reference to the statement of Lord Rayleigh that there is no possibility of distinguishing between the consonants F and S in the telephone. The author gives an account of the results of a systematic investigation of the telephonic distortion of speech, made by the American Telephone & Telegraph Company. For Lord Rayleigh's syllables fix and six, five and sive, about 85 per cent of the records were correct; haphazard records would have averaged only 50 per cent correct. Therefore, while it is obvious that the telephone seriously distorts speech-waves, nevertheless, even those consonants which most nearly resemble each other are not distorted sufficiently to be indistinguishable.—*Phil. Mag.*, January.

Coupled Circuits.—L. COHEN.—An article giving the mathematical theory of coupled circuits in which the secondary has distributed inductance and capacity.—*Bull. Bureau of Standards*, Vol. 6, No. 2, November, 1909.

Miscellaneous.

Institution of Mining Electrical Engineers.—This is a new British Association which held its inaugural meeting recently at Manchester. The president, W. Maurice, delivered an address dealing chiefly with the position of the electrical engineer at a colliery, and the urgent need for placing the responsibility for the maintenance of the electrical plant in his hands. He further emphasized the importance of careful attention to apparatus, illustrating his remarks from statistics. Thornton expressed the opinion that alternating-current working would supersede direct-current working in mines, and that even single-phase apparatus would eventually be used. Maurice, on the other hand, differed from Thornton on this point.—Lond. *Elec. Eng'ing*, Dec. 23.

Interconnection of Engineering Societies.—A letter referring to the formation of new engineering societies, such as the Institution of Mining Electrical Engineers just founded. The anonymous writer thinks that it would be a good policy for one of the existing great institutions to form a small advisory board whose privilege it would be to confer with other bodies, and to form, as it were, an "interconnector" between them. It would be formed of experienced men with a knowledge of the objects of all existing societies and institutions and, having authority to approach founders of any new movement; by interesting themselves in the objects, much could be done to prevent clashing of interests and thereby advance the science of engineering. The Institution of Civil Engineers embraces all branches of engineering in one powerful society, and is, therefore, in the best position to form a board to act as mediators.—Lond. *Elec. Eng'ing*, Dec. 23.

Boiler-Feed Waters.—E. G. BASHORE.—An article on the treatment of boiler-feed waters. The author first refers briefly to the addition of some substance in the boiler, for instance, some solvent (soda ash, etc.), for dislodging the scale. Metallic

zinc placed in the boiler counteracts the corrosive action of magnesium chloride and is generally useful to prevent corrosion by electrolytic action. The author then briefly refers to the preliminary treatment of the water in special feed-water heaters, and finally deals at greater length with the purification of the water by preliminary chemical treatment. The chief chemical questions involved in this problem are pointed out.—*Met. and Chem. Eng'ing,* January.

Marseilles Congress.—A full account of the proceedings, with concise abstracts of the different papers presented at the Marseilles congress on applied electricity in 1908.—Lond. *Electrician,* Dec. 31.

New Apparatus and Appliances

THREE-VOLTAGE RATING OF THE MAZDA LAMP.

We are indebted to the National Electric Lamp Association for the following interesting discussion of the three-voltage rating of the Mazda incandescent lamp:

The Mazda incandescent lamp, when operated at a specific consumption of 1.25 watts per candle, has proved itself far more economical than either carbon, Gem or tantalum lamps at all costs of energy above a few cents per kw-hour. There are some cases, however, in which the cost of energy per kw-hour is very low, perhaps a small fraction of a cent. In such cases a cheaper and less efficient lamp may show greater economy in not be overlooked in deciding the relative economy of high-efficiency versus low-efficiency lamps.

The incandescent-lamp manufacturers have recently made a radical change in their methods of rating these lamps, in order that the lamps may be used with greater economy under those certain conditions where heretofore their cost of operating exceeded that of a less efficient type of lamp. The results of this change are most valuable in cases where the cost of electrical energy is low. The new method of rating called the "three-voltage plan" is based on the fact that for any given set of conditions, depending upon the cost of energy and cost of lamps, there is a certain specific consumption and life at which

TABLE I—SHOWING TOTAL COST OF PRODUCING LIGHT WITH TUNGSTEN LAMPS AT TOP, MIDDLE AND BOTTOM VOLTAGES, AT VARIOUS COSTS OF ENERGY

Nominal Watts.....	25			40			60			100			150			250		
Nominal Candle-Power	20			32			48			80			120			200		
Voltage.....	Top	Mid-dle	Bot-tom	Top	Mid-dle	Bot-tom	Top	Mid-dle	Bot-tom	Top	Mid-dle	Bot-tom	Top	Mid-dle	Bot-tom	Top	Mid-dle	Bot-tom
Watts per Candle.....	1.33	1.39	1.45	1.25	1.30	1.35	1.20	1.25	1.30	1.20	1.25	1.30	1.20	1.25	1.30	1.15	1.20	1.25
Actual Watts.....	25.0	24.2	23.3	40.0	38.9	37.8	60.0	58.0	56.5	100	98.0	94.2	150	145.5	141.2	250	242.5	235
Actual Candle-Power..	18.8	17.4	16.1	32.0	29.9	28.0	50.0	46.5	43.5	83.3	77.6	72.4	125	116.4	108.6	217.3	202.0	188.0
Total Lumens.....	184.2	170.5	157.8	309.8	289.4	271.0	490.0	455.7	426.3	816.0	760.0	710.0	1225	1141	1064	2104	1954	1819
Lumens per Watt.....	7.36	7.05	6.77	7.74	7.44	7.17	8.16	7.86	7.54	8.16	7.76	7.54	8.17	7.84	7.54	8.41	8.05	7.74
Hours Life.....	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700	1000	1300	1700
Kw. H'rs per 1,000 H'rs	25.0	24.2	23.3	40.0	38.9	37.8	60.0	58.0	56.5	100	98.0	94.2	150	145.5	141.2	250	242.5	235
Cost of Frosted Lamp.	$0.75	$0.75	$0.75	$0.85	$0.85	$0.85	$1.17	$1.17	$1.17	$1.55	$1.55	$1.55	$2.25	$2.25	$2.25	$3.20	$3.20	$3.20
Lamp Renewals per 1000 Hours....	.75	.58	.44	.85	.65	.50	1.17	.90	.69	1.55	1.19	.91	2.25	1.73	1.32	3.20	2.46	1.88

COMBINED COST OF ENERGY AND LAMP RENEWALS PER 100,000 LUMEN-HOURS, IN DOLLARS

VARIABLE COST OF ENERGY CENTS PER KW. HOUR																		
	1	$0.54	$0.48	**$0.43**	$0.40	$0.36	**$0.32**	$0.36	$0.32	**$0.29**	$0.31	$0.29	**$0.26**	$0.31	$0.28	**$0.26**	$0.27	$0.25	**$0.23**
	2	.68	.62	**.57**	.53	.49	**.46**	.48	.45	**.43**	.44	.41	**.39**	.43	.41	**.39**	.39	.37	**.36**
	3	.81	.76	**.72**	.66	.63	**.60**	.61	.58	**.56**	.56	.54	**.52**	.55	.53	**.52**	.51	.50	**.49**
	4	.95	.90	**.87**	.79	.76	**.74**	.73	.71	**.69**	.68	.67	**.66**	.67	.66	**.65**	.63	**.62**	**.62**
	5	1.09	1.04	**1.02**	.92	.90	**.88**	.85	.83	**.82**	.80	.80	**.79**	.80	**.79**	**.79**	.76	**.75**	**.75**
	6	1.22	1.18	**1.17**	1.05	1.03	**1.02**	.97	**.96**	**.96**	.93	.93	**.92**	**.91**	.92	.92	**.86**	.87	.88
	8	1.49	1.47	**1.46**	1.31	**1.30**	**1.30**	**1.22**	**1.22**	**1.22**	**1.17**	1.19	1.19	**1.16**	1.17	1.19	**1.10**	1.12	1.14
	10	**1.75**	**1.75**	1.76	**1.57**	**1.57**	1.58	**1.46**	1.47	1.49	**1.42**	1.45	1.46	**1.41**	1.43	1.45	**1.34**	1.36	1.40
	12	**2.03**	2.04	2.05	**1.82**	1.84	1.86	**1.71**	1.72	1.75	**1.66**	1.70	1.72	**1.65**	1.68	1.72	**1.58**	1.62	1.65
	16	**2.57**	2.59	2.64	**2.34**	2.37	2.42	**2.20**	2.23	2.28	**2.15**	2.22	2.25	**2.14**	2.19	2.25	**2.05**	2.11	2.17
	20	**3.12**	3.16	3.28	**2.86**	2.91	2.97	**2.69**	2.74	2.81	**2.64**	2.73	2.78	**2.63**	2.70	2.88	**2.53**	2.61	2.69

Spherical Reduction Factor: 25, 60, 100 and 150-watt lamps=78 per cent.
40 and 250 watt lamps,=77 per cent.

operating expense than the Mazda lamp operated at 1.25 watts per candle. The somewhat higher renewal expense of the latter lamp at this specific consumption may not be counterbalanced by even a great reduction in the amount of energy used where the charge is low. Since the Mazda incandescent lamp is inherently of higher efficiency and quality, the question of its economical application to any particular case depends merely upon its operation at the correct specific consumption. In the case just cited, a small sacrifice in efficiency of the Mazda lamp could be made in order to reduce the renewal expense and thus secure greater economy than could be obtained with the other types of lamps, even when using very cheap energy. Besides the actual saving in energy made possible through the use of the Mazda lamp, there is the very important possibility of releasing generating equipment, which even where the operating cost is low, may often be of great value. This point should it is most economical to operate a given lamp. Each Mazda lamp is labeled with three voltages, 2 volts apart, as, for example, 114, 112 and 110, called "top," "middle" and "bottom" voltage, respectively, from their positions on the label.

This method of rating makes it possible for a customer to select the particular specific consumption he wishes to use, by specifying that either the top, middle or bottom voltage, as the case may be, should be the same as that of his lighting circuits.

When used at the top voltage the Mazda lamp consumes the least energy for the light produced, and gives a life of 1000 hours. At the middle voltage more energy is consumed per candle-power produced, and the life is lengthened (due to operation at a lower temperature) to 1300 hours. At the bottom voltage the lamp is operated at the lowest efficiency and gives a life of 1700 hours. It is obvious that the relative cost of lamp and energy will determine the most economical life and

efficiency, since if energy is cheap the saving obtained by operating the lamp at high efficiency is not sufficient to counterbalance the resulting higher renewal expense. On the other hand, if energy is relatively expensive, then it will be desirable to operate the lamp at a high efficiency, since the saving in energy at the higher rate will more than pay for the increase in renewal expense.

The specific consumption of the different sizes of lamps at the top voltage is not the same, since the larger lamps are relatively longer lived than the smaller ones, and, in order to give all sizes a uniform life of 1000 hours at the top voltage, it was necessary to operate the 25-watt lamp at 1.33 watts per candle, the 40-watt lamp at 1.25, the 60-watt, 100-watt and 150-watt lamps at 1.20, and the 250-watt lamp at 1.15 watts per candle.

The advantage of the new plan will be apparent by referring to Table I, accompanying, which shows the cost of producing light with Mazda lamps. This table is based on the list-price of bowl-frosted Mazdas and shows the total cost of operating the several sizes at top, middle and bottom voltage with costs of energy from 1 cent to 20 cents per kw-hour. The total cost given in the table includes the cost of the energy consumed and the renewal expense involved in the production of a quantity of light equivalent to 100,000 lumen-hours (which is equal to about 10,200 mean horizontal candle-hours in the case of the Mazda lamp).

The manner in which the most economical efficiency varies with the cost of energy is also shown in Table I, where we may take, for example, the cost of producing 100,000 lumen-hours with a 60-watt Mazda, at top, middle and bottom voltages, using energy at costs of from 1 cent to 20 cents per kw-hour. With the 60-watt bowl-frosted Mazda lamp, and with energy at 1 cent per kw-hour, a certain number of candle-hours can be produced most cheaply if the lamp is operated at the bottom voltage. The difference between the cost at top and bottom voltages, with energy at this rate, is about 19 per cent. With 5-cent energy the bottom voltage is still the cheapest, but is now only about 3 per cent cheaper than at the top voltage. At 8 cents per kw-hour it is as economical to operate at the top and middle voltages as at the bottom voltage, and above 8 cents the top voltage is the most economical. Where the per cent saving, which it is possible to obtain by operation at the bottom voltage, is slight, as, for example, in the case just considered with energy above 5 cents per kw-hour, it is far better to use the lamps at the top voltage and thus secure not only a better quality of light, but also more light from a lamp of given size.

The greatest benefit can be derived from the three-voltage plan, however, at the low rates for energy. Operation at bottom voltage will then show economy for the Mazda lamps over either carbon, Gem or tantalum, down to energy costs as low as 0.2 cent per kw-hour.

Table II shows the comparative cost of producing 100,000 lumen-hours with carbon, Gem, tantalum and Mazda lamps at costs of energy from 0.2 cent to 1 cent per kw-hour. This table is based on conservative total-life values of the carbon and Gem lamps in place of the usual useful life, since practically all lamps are left in service until ultimately burned out, rather than only until they have dropped to 80 per cent of this initial candle-power. The Mazda lamps have all been computed at bottom voltage, and the Gem lamp has been treated in the same way, as this is the most economical voltage for such low costs of energy. The average values for candle-power and watts during the life periods shown have been taken in every case, rather than the initial values, because the Mazda lamp maintains its candle-power much better than the other types. This feature is a distinct advantage in its favor and should be considered in comparing it with other types of lamps. The costs of lamps taken in this table are those for clear lamps in standard package quantities.

For energy costs above 5 cents any percentage saving that it is possible to obtain by operating the Mazda lamps at other than the top voltage becomes so small as to be negligible in comparison with the better quality of light obtained at the higher voltage. Only in those cases where energy is very cheap should anything but the top voltage be seriously considered. For ordinary use on central-station circuits at the usual central-station rates the top voltage should always be used. The prime object of the three-voltage plan, as applied to Mazda lamps, was to widen the field of its commercial application by making it competitive with the cheaper and less efficient lamps on low cost of energy.

TABLE II—SHOWING COMPARATIVE COST OF 100,000 LUMEN-HOURS—CARBON, GEM, TANTALUM AND TUNGSTEN-LAMPS, WITH ENERGY BELOW 1 CENT PER K.W. HOUR

Rating		Carbon		Gem	Tantalum	Tungsten					
		16 C.P.	16 C.P.	20 C.P.	20 C.P.	25 W.	40 W.	60 W.	100 W.	150 W.	250 W.
		3.1 W.P.C.	3.5 W.P.C.	Bot. Voltage	2 W.P.C.—D.C.	Bottom Voltage					
Actual Initial Candle-Power		16	16	16.7	20	16.1	28.0	43.5	72.4	108.6	188.0
Actual Initial Watts		49.6	56	47.3	40.0	23.3	37.8	56.5	94.2	141.2	235.0
Nominal Watts per Candle		3.1	3.5	2.83	2.00	1.45	1.35	1.30	1.30	1.30	1.25
Hours Life		800	1700	1450	1200	1700	1700	1700	1700	1700	1700
Average Candle-Power During Life		13.20	13.06	14.00	21.66	16.46	28.30	42.60	71.50	107.2	179.7
Average Watts During Life		48.6	54.9	40.2	41.0	23.9	38.6	55.6	92.6	138.8	241.3
Reduction Factor		82.5	82.5	82.5	79.0	78	77	78	78	78	77
Lumens		138	135	145	215	161	274	417	701	1051	1739
Cost of Lamp, Standard Package		$0.18	$0.18	$0.225	$0.405	$0.567	$0.648	$0.891	$1.175	$1.701	$2.430
Cost of Energy, Cents per K.W.H.	.2c.	$0.233	$0.160	$0.162	$0.195	$0.237	$0.167	$0.152	$0.125	$0.122	$0.110
	.3	.269	.200	.190	.214	.252	.181	.166	.138	.135	.124
	.4	.303	.241	.218	.233	.266	.196	.179	.151	.148	.138
	.5	.339	.282	.246	.253	.281	.210	.192	.165	.161	.152
	.6	.374	.323	.273	.272	.296	.224	.206	.178	.175	.166
	.8	.445	.404	.329	.310	.326	.252	.232	.204	.201	.103
	1.0	.515	.485	.384	.348	.355	.280	.259	.231	.207	.221

CHICAGO ELECTRICAL SHOW NOTES.

Some very large carbon electrodes for electric furnace work are in the exhibit of the National Carbon Company. The largest, of solid carbon, is 6 ft. high and 16 in. square, weighing 1159 lb.

Perhaps the greatest novelty of the show is the electric altar-bread oven shown in the industrial exhibit of the Commonwealth Edison Company. This appliance, which bears the name "St. Mary," is supplied with a Simplex electric oven and is equipped with molds or stamping devices, so that as the pieces of communion bread, or wafers, are baked, they are at the same time marked with a cross, a crucifix, the letters "I H S," or other church emblems. J. P. Daleiden & Company, 514 West North Avenue, Chicago, make this device.

Popular interest seems to be particularly excited by the Chicago Telephone Company's working section of an exchange shown as in actual service. There is always a throng of interested spectators behind the six young women operators, who seem to have been selected for their good looks as well as their

GAS-PRODUCER ELECTRICAL PUMPING PLANT.

For supplying the motor-driven pumps of its municipal water filtration plant, the city of Cohoes, N. Y., has installed two Westinghouse gas-engine driven, direct-current generator sets, using producer gas as fuel. Both engines are of the three-cylinder type, 15 in. x 14 in., and develop 125 hp. They are direct-connected to two 75-kw, 125-volt Westinghouse direct-current generators. The output of these machines furnishes power for the motors driving the pumps of the city water supply, besides several other small motors about the plant, and the local lighting. The producer gas for this installation is derived from two 125-hp Westinghouse gas producers. The use of the gas producer in connection with the gas engine in a small plant of this kind is found to secure many advantages of economy, efficiency and ease in operation over the equivalent combination of boilers and steam engines. The large number of such gas-producer plants which have been installed in this country attest the increasing popularity of this modern type of power plant.

CHICAGO CONFERENCE OF GENERAL ELECTRIC SALESMEN.

About 150 representatives of the General Electric Company, under the supervision of the Chicago office, which has for its territory the Middle West, attended the annual salesmen's conference at the Great Northern Hotel, in Chicago, on Jan. 10 to 15, inclusive. There were a number of factory representatives present, and the new apparatus was carefully described and plans discussed for the selling activity of the year 1910 in this territory. Many of the addresses of the factory representatives were illustrated by lantern-slide pictures. Mr. J. W. Johnson, manager of the Chicago office, welcomed the visitors and made the opening address. The general supervision of the meeting was in the hands of Mr. Johnson, with whom Mr. Frank N. Boyer, assistant manager of the Chicago office, co-operated. The meeting was divided into sections on the successive days, presided over by the heads of the departments in the Chicago office, as follows: Railway department, Mr. H. L. Monroe; lighting department, Mr. J. Scribner; power and mining department, Mr. W. T. Dean; small-motor department, Mr. S. F. Dibble; supply department, Mr. W. H. Colman. Among the factory representatives present were: Lighting department, Messrs. M. Tattersfield and E. W. Allen; steam-turbine department, Mr. Richard H. Rice; power and mining and small-motor departments, Messrs. A. W. Henshaw, C. W. Holgate, C. D. Knight, F. M. Kimball, M. J. Fitch; supply department, Messrs. Wallace Clark, J. C. Dallam, F. G. Vaughen, N. R. Birge, F. H. Gale, R. H. Carlton, A. D. Page, G. C. Osborn and C. L. Smith. All the factory representatives named were from the Schenectady works, except that Messrs. Fitch and Kimball came from the Lynn factory and Messrs. Page and Osborn from the lamp works at Harrison, N. J.

On Jan. 12 the entire party made a trip to Gary, Ind., where the interesting electrical equipment of the mills of the Indiana Steel Company was inspected. On Jan. 14 the party visited the new Chicago warehouse of the General Electric Company on Illinois Street. This warehouse consists of two sections of the Pugh terminal warehouse, which is an imposing building, being about one-quarter of a mile long.

SIMPLIFIED SIGN FLASHER.

The Reynolds Electric Flasher Manufacturing Company, Chicago, has brought out an entirely new line of electric flashers characterized by simple construction. As shown in the accompanying illustrations, the switches are not closed and opened by cams, but by toothed wheels. The switches are strong and durable, and close into self-lubricated jaws of such ample proportion that any heat caused by an arc is quickly dissipated. The Reynolds company has always held that anything other than good copper switches, such as carbons, etc., are merely makeshift devices to overcome faulty design of switches, and claims that the use of this new flasher on the hardest kind of service on large combination signs amply sustains its position. The company states that these flashers have been in service on overloads for the last six months and the switches and jaws show no sign of having been used, which would not be the case if the contacts had been made and broken on poorly designed and ill-proportioned working parts. As shown, the worm gearing is entirely enclosed and runs in an oil bath, which eliminates wear. The make-and-break is accomplished by roller teeth, which also overcomes any undue friction.

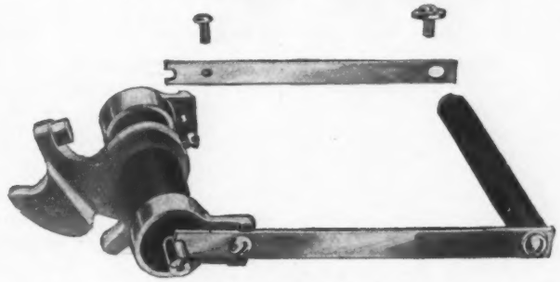


Fig. 2—Switch Blades.

Fig. 1—Switch Jaws.

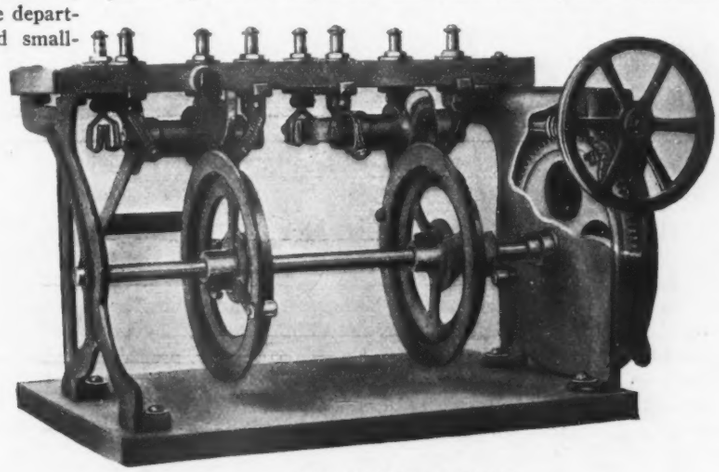


Fig. 3—View of Flasher.

All working parts are so designed that a novice can renew any part should an accident call for a renewal. All large flashers of the combination style are wired into lamps on a special test board and timed to give accurate lighting effects on the sign for which they are intended before being shipped. Chain drives have been abandoned and when various ratios of speeds are desired, they are obtained by means of accurately cut gears.

skill. The various "wireless" demonstrations, also, both telegraph and telephone, are always sure of an audience.

Besides the *Electrical World*, the other periodicals making exhibits are *Electrical Age, Electrical Record, Electrical Review and Western Electrican, Electrocraft, Popular Electricity* and *Telephony*.

A beautiful novelty is the new, white, translucent Alba glass of the Macbeth-Evans Glass Company, made in the shape of hollow columns or other structural forms. With lineolite lamps inside, the columns and capitals look like softly glowing marble and are most attractive.

The four smart laundry operators at work for the Davies Laundry Company in the Simplex booth are particularly neat-looking men and women, and with their electric irons they execute hand work in a manner that seems to be very well done.

Considerable attention is attracted by the exhibit of electrically heated garments, particularly bathrobes. The bathrobe shown appears to be of an ordinary woolen fabric, provided, however, with an interlining consisting of a resistance wire of which it is said that 7000 ft. are employed for each garment. This wire is said to add but 20 ounces to the weight of the bathrobe and is so designed that by attaching a flexible cord to an ordinary 110-volt socket the temperature of the garment can be raised to 135 deg. Fahr. in a very few minutes. By this means the owner of the bathrobe can take a mild Turkish bath in his own home and it is also asserted that the warmth from the robe gives relief in cases of rheumatism.

One of the spectacular features of the show is the cutting of iron and steel by melting it by the intense heat of the electric arc. Mr. J. E. Haschke gives an exhibition of this character, using a storage battery to supply electricity to a carbon point of his own design. Large holes are perforated through a piece of five-ply chrome steel. Mr. Haschke declares that he does not exploit this with the idea of assisting the dark-lantern fraternity to break into safes, but rather to open safes and vaults where other means fail and also to wreck large iron structures more rapidly and conveniently than is practicable by other methods.

In the Annex a number of amateur or student wireless operators keep themselves pretty busy. Their efforts lead to considerable interference, and one and all they declare that "the Government ought to do something to keep the 'wireless kids' from 'butting in.'" Who are to be the sheep and who the goats among the "wireless kids" has not yet been determined, apparently. One of the boys gives it as his opinion that the Government should organize a force of wireless operators to be drawn upon in the case of war, as is done in the case of the militia. "If war should break out with any other country," says this young man, "the United States would need thousands of operators, and if they were drilled and prepared in advance, they would be ready when needed."

Newspaper cartoonists have paid an unusual amount of attention to the show, largely owing to the efforts of the Commonwealth Edison Company, which arranged with a number of cartoonists on Western daily newspapers to make pictures giving their impressions of the show. These pictures are printed in the advertisements of the central-station company in the Chicago daily papers and attract considerable attention.

One of the automobile exhibitors which came in late and was not mentioned in the *Electrical World's* list of last week, is the Anderson Carriage Company, of Detroit, Mich., which exhibits a handsome "Detroit Electric," model D, extension coupé for four passengers. Mr. F. E. Price represents the company.

The new electric hammer, or drill, recently described in this journal, is shown in operation making holes in concrete. As a new tool it attracted attention from both electrical men and laymen.

Much admiration is expressed for the novel illuminating effect by which the light from six 30-in. projectors is thrown on thousands of yards of ribbon and tinsel hanging in vertical strips from the ceiling. The color effects on the gold and silver tinsel and yellow and gray ribbon are particularly beautiful. The best effect is obtained when the quantity of light for the booth illumination is reduced. Then the "fairyland" effect of the streamers comes out in all its gorgeousness.

At the free lectures of Mr. M. M. Wood, in the hall at the south end of the exhibition, a feature is a moving-picture representation of two maids in a kitchen cooking a meal by electricity. Scenes in the electrically operated laundry and in the living-room of an electrically equipped house are also shown by moving pictures. Other moving pictures depict flights of the Wright aeroplane near Washington, D. C. Mr. Wood's witty comments add to the success of the lectures.

In the Westinghouse booth the plates of the Westinghouse Storage Battery Company and the lamps of the Cooper Hewitt Electric Company were shown, in addition to the other exhibits. Mr. J. C. McQuiston, of the Westinghouse Companies' publishing department, was a visitor at the show last week.

A successful rejuvenation of the Sons of Jove was accomplished on Jan. 21. A large number of candidates were initiated, and afterward there was good cheer at a supper.

Not a few of the conventioneers from the Wisconsin Electrical Association at the Milwaukee meeting visited the show after the conclusion of their own business.

The ingenious electric portable tools of the Chicago Pneumatic Tool Company attracted attention. Motors are directly attached to drills, grinders, spike drivers, etc., and the tool is not too heavy to be carried about.

Ingenious instantaneous electric water heaters, shown by the Consolidated Electric Appliance Companies of San Francisco, are comparatively new in the East. By turning a switch running hot water can be drawn off almost instantly. The bathtub heater takes 50 amp at 220 volts, and there are also basin, tank and dental heaters, taking less current. These heaters are of the carbon type and do not use resistance wire. A barber's urn, drinking-bar heater and other kinds are shown.

Many varieties of vacuum cleaners are shown. One, that of the Nohe Electric Renovator Company, is a novelty, in that it consists essentially of a centrifugal fan driven by a ⅛-hp motor at a very high speed, said to be 5000 r.p.m. A small auxiliary fan is connected on the shaft to keep the motor cool.

The Commonwealth Edison Company distributed some attractive literature, including a book of cartoons and a pamphlet, "Houses We Have Wired at Cost," which is itself in the outline of a house.

A large number of out-of-town central-station men were present. Among them were Messrs. W. C. L. Eglin, Philadelphia; W. F. Wells, Brooklyn; F. S. Norman, New York; T. C. Martin, New York; I. E. Moultrop, Boston; L. L. Elden, Boston; C. H. Hodskinson, Boston; W. A. Martin, Quincy, Ill.; A. G. Moser, Galesburg, Ill.; Joseph E. Montague, Niagara Falls; Wm. R. Huntley, Buffalo; George W. Ames, Buffalo; W. M. Warner, South Bend, Ind.; F. P. Ohmer, South Bend, Ind.; J. H. Harding, La Porte, Ind.; W. H. Winslow, Superior, Wis.; O. U. Rau, Milwaukee; Frank McMaster, Beatrice, Neb.; F. G. Jones, Oregon, Ill.; Chas. H. Cox, Mattoon, Ill.; E. H. Negley, Canton, Ill.; John R. Webster, Omaha; R. W. Hemphill, Jr., Ann Arbor, Mich.; A. L. Dodd, Charles City, Iowa; A. C. Sadler, Earlville, Ill.; R. B. MacDonald, Fort Dodge, Iowa; C. F. Farley, Kansas City; B. M. Fast, Springfield, Ill.; G. F. Lyons, Beloit, Wis.; H. R. Kingman, Mt. Vernon, Ill.; Elmer W. Smith, Kewanee, Ill.; F. S. Armstrong, Macomb, Iowa; Louis W. Hess, Ottawa, Ill.; P. P. Crafts, Clinton, Iowa; W. E. McCollough, Beardstown, Ill; I. B. Zimman, Omaha; Wm. A. Donkin, Pittsburg.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Reports of trade during the past week continued to be favorable, although the widespread inclemency of the weather has done much to retard business in many sections and has interfered, to a large extent, with transportation and with the movement of the farmers' products to market. The best reports are coming from the Southwest, where the weather is much better than in any other section of the country. In Oklahoma, Texas and Louisiana business has been especially good. Throughout the Northwest the prevalence of heavy snows is regarded as being extremely favorable to the winter wheat crop. From the wholesalers and jobbers all reports are encouraging. Traveling men are now scattered all over the country, and good spring orders are being received and encouraging reports are coming in from these representatives. In the industrial line all of the indoor trades continue to be very active, especially the iron and steel industry, and orders are, as a rule, being booked so far ahead that a long period of full time work seems in prospect. The high prices for commodities are also a detriment to business activity. The more conservative retailers hesitate to fill their shelves with goods at the present range of prices, and the purchasing power of the consumer is notably curtailed. The violent fluctuations in the price of raw cotton have done much to handicap the manufacturers of textiles. Collections continue to be rather unsatisfactory, owing to the interference with the marketing of products. Business failures for the week which ended Jan. 20, as reported by *Bradstreet's*, were 275, as against 291 the week previous; 307 in 1909; 408 in 1908; 252 in 1907 and 276 in 1906.

THE COPPER MARKET.

Transactions in copper during the past week have been very light, but price changes have been merely fractional. Not only has the demand for consumption at home and abroad been small, but there has been practically a cessation of speculative activity. In fact, in Europe there appeared on several days considerable selling pressure on the part of the speculators. Second-hands, especially those that have been carrying copper for a long time, showed a disposition to get rid of their holdings, and from these some price concessions have been reported in London. The domestic producers in this country have not been pressing sales, and therefore prices have remained steady. It is well known that the stocks in the hands of consumers in this country are ample for all immediate requirements, and there seems to be a disposition to let the market rest until conditions are better. In the meantime the statistical position of copper gives evidence of being improved. It is expected that the curtailment in production during January will be fully as great as it was in December, which was in the neighborhood of 25,000,000 lb. If this policy is kept up for a few months, and if industrial conditions continue to improve, the demand will more nearly reach the supply. There has been little heard in the market concerning mergers. Nothing new has developed with regard to the great Amalgamated combine, and the Utah Copper Company merger has been temporarily stopped by an injunction suit brought by the minority stockholders of the Nevada Copper Company. Exports for January, including Jan. 24, have been 17,317 tons. The daily call on the Metal Exchange Jan. 24 quoted standard copper as shown in the table.

	Bid.	Asked.	Settling price.
Spot	13.25	13.37½	....
January	13.25	13.37½	13.30
February	13.25	13.37½	13.30
March	13.25	13.37½	13.30

The London prices Jan. 24 were as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	60	12	6	60	12	6
Standard copper, futures	60	12	6	61	10	0
Market	Firm			Easy		
Sales of spot	300 tons					
Sales of futures	500 tons					

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	13.50c			13.25c		
London, spot	£62	0	0	£60	3	9
London, futures	62	18	9	61	2	6
London, best selected	65	10	0	64	0	0

Central Georgia Power Company.—Work upon the dam of the Central Georgia Power Company on the Ocmulgee River, near Jackson, Ga., has progressed so far that all of the foundations of the entire dam are completed, and the work on the upper part of the dam and on the power house is progressing rapidly. It is said that the installation will be completed within the near future, and that power will be delivered in the coming fall. J. G. White & Company, of New York, are the engineers of this proposition. The dam is about 100 ft. high and is 1450 ft. long over all. Its construction will require 160,000 cu. yd. of concrete. When the power house is ultimately completed it will comprise six units of 3000 kw each. Four of these units will be installed as soon as the power house is ready. The ultimate output of the plant is estimated at 24,000 hp. Transmission lines will be run into Macon, Griffin and the surrounding territory, and the transmission will be made from the power house at 60,000 volts. There will be six substations, at which the current will be stepped down to any voltage that is required by customers. The company has been organized under the laws of Georgia with a capitalization of $4,000,000 and with an authorized bond issue of $3,000,000, $2,500,000 of which has been issued, leaving $500,000 in the treasury for extensions and improvements.

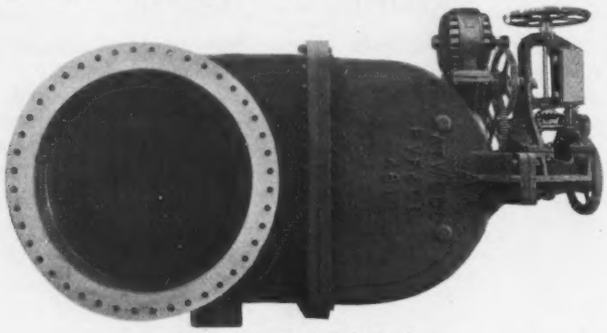
Stone & Webster in New York.—Stone & Webster, of Boston, announce that they have opened offices in the Hanover Bank Building, 5 Nassau Street, New York. These offices are opened for the purpose of dealing in securities of the electric railway, lighting, power and gas companies which are under the direct management of the Stone & Webster firm. The Stone & Webster Engineering Corporation, which does a general engineering and construction business, will also be represented at these offices. The former New York offices at 45 Cedar Street will be closed. The New York office hereafter will be in charge of John W. Hallowell and T. T. Whitney, Jr. Guy E. Tripp, of the Stone & Webster firm, who is now chairman of the Metropolitan Street Railway Reorganization Committee, will make his headquarters in the new office. The Stone & Webster Engineering Corporation had at the first of the year $11,341,000 of construction in progress. This is divided; water-powers, $4,140,600; interurban railways, $2,609,700; street railways, $777,700; steam power stations, $940,000; buildings, $2,495,000, and miscellaneous, $380,000. This work is largely in the far West and in the South.

Carolina-Tennessee Power Company.—Plans have been drawn for the development of an extensive hydroelectric proposition on the Hiawasse River in western North Carolina, near the border line of Tennessee. The proposition has been promoted by Ketcham & Company, 115 Broadway, New York. It is given out that all of the necessary property along the banks of the river has been secured, and that two dams will be constructed 13 miles apart. Each of these dams will be more than 1000 ft. long and 150 ft. high. The watershed drain will amount to about 37,500 acres. The lower dam, which will be the first constructed, is only 13 miles from Ducktown, Tenn., where are located the Tennessee Copper Company and Ducktown Copper Company. W. L. Church is the engineer in charge of the construction work. The Carolina-Tennessee Power Company is capitalized under the laws of North Carolina with $250,000 capital stock issued, and with the privilege of increasing to $5,000,000.

Vacation for George Westinghouse.—The board of directors of the Westinghouse Electric & Manufacturing Company has voted a six months' leave of absence to George Westinghouse, president of the company. Mr. Westinghouse will spend this vacation abroad. He was entertained in Boston on Jan. 22 at a dinner given by the Boston branches of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Boston Society of Civil Engineers, at which he delivered an address which is printed elsewhere.

ALTERNATING-CURRENT MOTOR-OPERATED GATE VALVE.

The large alternating-current motor-operated gate valve shown in the accompanying illustration is installed at the plant of the Pressed Steel Car Company, McKees Rocks, Pa., where it is inserted in the exhaust line from a 1000-kw Westinghouse low-pressure turbo-generator. The valve closes upon a clear opening 48 in. in diameter and is operated by a 3-hp, three-



Motor-Operated Gate Valve.

phase, 60-cycle, 550-volt Westinghouse type CCL induction motor. The motor speed of 1120 r.p.m. is reduced through suitable gearing to the speed of the main operating thread proper for closing the valve safely and quickly. A hand-wheel for hand closing is also provided. A wormgear on one of the intermediate shafts operates a limit-switch mechanism which automatically controls the movement of the gate by stopping the motor at a certain point in the gate travel either way.

To open or close the valve it is thus necessary only to throw the operating switch into the corresponding position. This starts the motor, which continues to run until it is automatically cut off when the end of the valve travel is reached. The valve is thus operated with the absolute minimum of effort or trouble, and can be closed or opened at the predetermined safe operating speed as easily as switching on an electric lamp. The limit switch which accomplishes this automatic control is enclosed in the box shown at the right of the valve gear. The operator's switch, by which the valve is opened or closed, may be located in any convenient position about the building or plant.

The assembly of the motor and gearing in the instance shown was a special construction made necessary for clearing the neighboring pipes and walls.

The 48-in. gate valve just described was designed and built by the Pittsburgh Valve Foundry & Construction Company, Pittsburgh, Pa., the motor and limit-switch device being furnished by the Westinghouse Electric & Manufacturing Company.

GUARANTEE ELECTRIC COMPANY ERECTING A BUILDING OF ITS OWN.

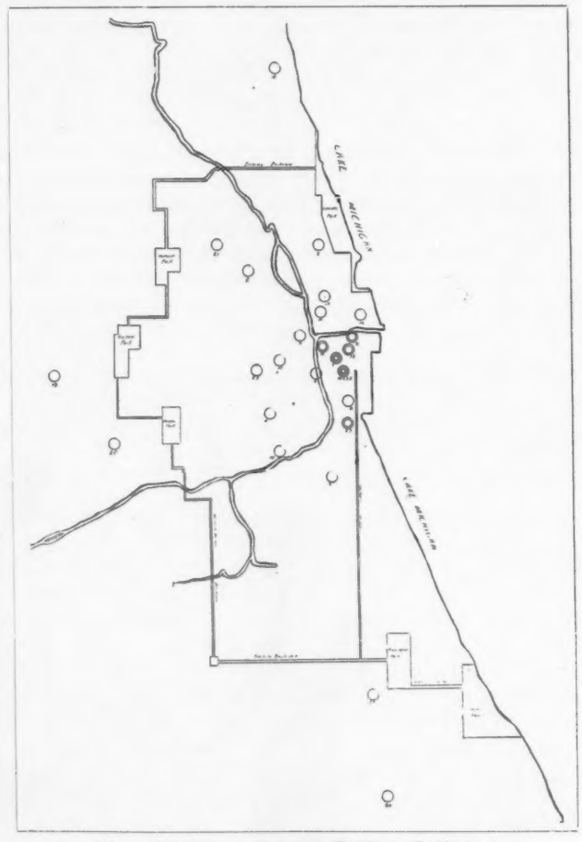
With the steady growth of its business the Guarantee Electric Company, now at West Adams and Clinton streets, Chicago, finds it necessary to have its own plant. Accordingly, property has been secured on the corner of Clinton and West Van Buren streets, where the company is erecting a modern, six-story warehouse and plant for its business. Since beginning operations in 1899 in a small way on South Canal Street, with a stock of about half a dozen dynamos and motors, the company has had to move several times to obtain more space, and it now carries over 1000 dynamos and motors and a complete line of electrical supplies. In the new building there will be handsome display-rooms, as well as well-equipped departments for testing and rebuilding apparatus. The warehouse floor will be of solid concrete, resting directly on the ground, to enable it to carry any weight which may be put upon it, and thus affording facilities for the largest units. Electric overhead traveling cranes will be used in transporting the heavy machinery about the premises.

An important feature of the business is the testing department. Here dynamos and motors of all sizes, voltages and phases may be tested to their full capacity, alternating current when needed being obtained by means of a motor generator set. This machine consists of a direct-current, 220-volt motor driving an alternating-current generator wound so as to give 60 cycles or 133 cycles, as desired, with varying phases and voltages, the latter being obtained by transformers used in connection with the machine. The necessary switches and controlling apparatus for this unit are placed on a large switchboard.

The machine shops will be well lighted and designed for convenience in operation, and every machine tool will have its individual electric motor. In the supply department will be perhaps the most attractive part of the establishment, for elaborate plans have been made to display the stock in the showrooms to the best advantage. The officers of the company are: President and general manager, Mr. Edwin R. Rockwell; treasurer, Mr. Gilbert B. Shaw; secretary, Mr. J. H. Benham.

MAP OF CHICAGO STORAGE-BATTERY STATIONS.

One of the exhibits at the Chicago Electrical Show that attracts considerable attention is an outline map of Chicago on which are indicated the locations of the large storage batteries installed for the Commonwealth Edison Company and various railway companies and now in service. There are 33 of these batteries at 25 different locations, and the total capacity is 36,805



Map of Chicago Storage-Battery Stations.

kw. Twenty-two of the batteries at 16 locations are in the service of the central-station company, and the remainder are divided among the Northwestern Elevated Railroad Company, the Metropolitan West Side Elevated Railway Company, the South Side Elevated Railroad Company and the Chicago City Railway Company. In the cut the number of rings at each location shows the number of batteries installed. Chloride accumulators are used in each battery. The manufacturer styles this service "Chicago's Electrical Watch Dog."

St. Lawrence Power Company.—The Dominion Government has referred to the Canadian section of the International Waterways Commission for its consideration the proposals of the promoters of the large power development works at the Long Sault Rapids on the St. Lawrence River near Cornwall. Mention of this undertaking was made in our issues of Nov. 4 and Jan. 13. The company, represented by President F. H. McGuigan and Directors Henry Holgate, of Montreal, and Leighton McCarthy, of Toronto, waited on the members of the Cabinet on Jan. 17 and presented their revised plans for the damming of the river and the construction of a new lock channel to replace the present channel, via the Cornwall canal, on the north side of the river. They maintained that the project would not interfere with navigation as claimed by the shipping interests, but, on the other hand, would improve the accommodation at that point. According to the company's plans, a total development of about 600,000 hp is contemplated, to be equally distributed between the United States and Canada, although, pending a market for half of the local development on the Canadian side, permission is asked to export the surplus to New York State. The company now holds a charter from the New York State Legislature empowering the construction of the works and the distrbiution of electrical energy on the American side.

Official Changes in Montreal Power Company.—In addition to the changes in the personnel of the officials of the Montreal Light, Heat & Power Company, announced in our issue of Jan. 13, owing to the death of the late managing director and chief engineer, W. McLea Wallbank, the directors have appointed J. S. Norris, secretary-treasurer, to the additional position of general manager, newly created. Mr. Norris will perform some of the duties formerly under Mr. Wallbank's direction. R. M. Wilson, formerly general superintendent of the electrical department, is made chief electrical engineer. Rumors are again in circulation of the ultimate merger of not only the Montreal Street Railway and Montreal Light, Heat & Power Companies, but probably also the Shawinigan Power Company. The stock of the Montreal Power Company has again risen and, as a result of the purchase of 3000 shares on behalf of the Shawinigan company, J. E. Aldred, president of the latter company, has been elected a director of the Light, Heat & Power company.

Large European Electrical Combination.—A working agreement has been arranged between the German electrical engineering company, Felten & Guilleaume-Lahmeyer, Mülheim-on-Rhine, and the French firm of Schneider & Company, Le Creusot. The agreement came into operation with the new year, and applies both to French and foreign electrical business. The arrangement is the outcome of several large orders which have been executed jointly by the Schneider company and the French branch of the German concern, the Société Anonyme d'Electricité Lahmeyer, Paris. These include the erection of a large rolling plant for heavy ship plate for the Italian firm, the Terri Iron Works, and a 1500-hp monophase locomotive for the Compagnie des Chemins de Fer du Midi, and it is thought that a definite business agreement will be of mutual benefit. An arrangement has existed for some time between the above two companies and the Escher-Wyss Company, Zurich, for the building of the Zoelly turbine for all three undertakings.

Lackawanna Electrification.—Instead of starting in at once with a broadly developed plan for electrification, the management of the Delaware, Lackawanna & Western Railroad Company is merely considering the possible electrification of some 25 or 30 miles on the mountain grade on either side of Scranton, Pa. The two principal electrical manufacturing companies in the country have been asked to prepare preliminary investigations and estimates of this work. A number of high officials in the railroad company are still of the impression that, with the present volume of traffic, the business over this section can be handled more cheaply by steam than by electricity. As everyone knows, the Lackawanna company is in a financial position to make any improvements that its management considers to be wise. Its investigation of electrification, therefore, is regarded as particularly significant.

Big Project for Chicago Tunnels.—It is said that 60 men, representing nearly $200,000,000, have recently visited Chicago on a special train for the purpose of inspecting the property of the Illinois Tunnel Company. These men visited Chicago as the guests of George W. Jackson, president of the Jackson Construction Company, the builder of the tunnel, and the purpose of their visit was to have them become interested in the development of an underground railway system in the City of Chicago. No definite statement has been given out since this excursion was made. Mr. Jackson says with regard to the franchise: "We would not attempt to build a passenger subway under the 20-year grant which has been suggested by the authorities. Fifty years would be about the smallest limit that we would be willing to undertake."

Sierra & San Francisco Power Company.—A suit has been filed by the Sierra & San Francisco Power Company, of California, against the Spring Valley Water Company to obtain rights-of-way for a transmission line in the vicinity of Dumbarton Point. The Sierra & San Francisco Company is the organization controlled by the United Railways Investment Company, of San Francisco, which recently took over the properties of the Stanislaus and Tuolumne hydroelectric companies. It has secured the rights-of-way for 50-ft. steel poles, to be located 800 ft. apart, through several counties from its hydroelectric plants to San Francisco. A small strip of land near Dumbarton Point, which was owned by the Spring Valley Water Company, has resisted the location of these transmission poles, and on that account this suit has been brought.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions of present plants at Erie, Kan.; Russellville, Ala.; Ralston, Okla.; Orange, Tex.; Chewelah, Wash.; Slater, Mo.; Shelbyville, Ind.; Long Beach, Cal.; Albermarle, N. C.; Tacoma, Wash.; London, Ont., Can.; Midland, Ont., Can.; Cherryvale, Kan., Escondido, Cal.; Valdosta, Ga.; Bridgeburg, Ont., Can.; Beaver Falls, Pa.; Cleveland, Ohio; Madison, Kan.; Greenfield, Mass.; Tyron, N. C.; Savannah, Mo.; Hespeler, Ont., Can.; Medicine Hat, Alta., Can.; Monte Vista, Col.; Emporium, Pa.; Worcester, Mass., and Pulaski, Va.

Big Contract for New York Edison.—The New York Edison Company has closed a contract with the Gimbel Brothers firm for furnishing the entire energy needed in the tremendous department store now nearing completion at Thirty-third Street and Broadway in New York. This establishment, it is claimed, will be the largest department store in the world. According to the announcement of the Edison Company, it will require energy for 60 high-speed electric elevators and "thousands of horse-power for other work." About 100,000 incandescent lamps will be used for interior lighting and for signs.

Long Island Railroad Company.—It is now given out that the first electric trains through the East River tunnels on the Long Island Railroad will be run some time in April. They will be operated from the Pennsylvania Railroad Station at Thirty-third Street and Seventh Avenue, Manhattan, to Jamaica. The Long Island Railroad is beginning to receive the steel cars which are to be used in its electric service. One hundred and forty of these cars will be delivered during the year, repressenting an investment of $1,250,000. In addition to this, repairs and extensions will have to be made to almost every station within the electric zone.

General Electric Buys Iron.—It was reported that the General Electric Company has recently closed contracts for 10,000 tons of high, medium and low silicon foundry iron for shipments over the second half of the year. Deliveries will be made at the Schenectady works. It is understood that this business has been divided between Buffalo and eastern New York State furnaces. The contracts were made on an analysis basis. It is stated that the contracts for the New England plants have not yet been closed.

Big Electric Plant at Long Beach, Cal.—Plans are being prepared for the construction of a large steam power plant by the Edison Electric Company, of Los Angeles, at Long Beach. The equipment of the plant, according to the plans, will include two turbines rated at 15,000 hp each. The plant will be located on the west side of the harbor and will cost about $2,100,000.

Chippewa Railway, Light & Power Company.—A. E. Peirce, Jr., assistant manager of the Chippewa Railway, Light & Power Company, of Eau Claire, Wis., writes that his company proposes to build a 50-ft. concrete dam and power house on the Red Cedar River, near Cedar Falls, Wis. The equipment of this power house will include four 2000-kw generators.

Lehigh Valley Railroad Telephones.—The Lehigh Valley Railroad Company has recently equipped two sections of its line with telephones for train dispatching. The first circuit of this sort was put into service recently on the Mahanoy & Hazleton division, the dispatcher being located at Hazleton, Pa. The other section to use the telephone will be the Lehigh division, where the line is at present under construction. This circuit will be 54 miles long, with 15 stations. On the Mahanoy & Hazleton division there are 10 siding telephones for use in cases of emergency. The entire equipment on the two circuits was purchased from the Western Electric Company. Gill main line bridging selectors are used in calling the way-stations on the circuits now in use, of which there are 35. In the way-stations special equipment, composed of a swinging arm with the transmitter and receiver mounted in a fixed position on a yoke, is utilized. When the operator pulls the arm forward a special switch closes the telephone circuit. When he wishes to talk he depresses a foot switch, which closes the primary circuit through the transmitter. A storage battery is used for operating the circuits and dispatcher's transmitters.

German Electrical Industry.—The London *Times* in a review of the present state of the German industries states that the electrical industry is in a very satisfactory condition, having recovered more rapidly from the effects of the 1907 business depression than other branches. The construction of central stations in Germany keeps the electrical works fully employed, and fresh opportunities are offered by the electrification of main railway lines. During the year the Prussian State railways have placed their first orders for locomotives for electrical traffic on main lines. In the storage-battery industry development has been less satisfactory, in consequence, it is said, of the competition caused by the construction of a network of central stations.

Edison Electric Illuminating Company of Boston.—The City of Waltham, Mass., has entered into a contract with the Edison Electric Illuminating Company of Boston for lighting its streets and public buildings for a term of 10 years, beginning Sept. 1, 1909. Under this contract the company is to furnish 506 tungsten lamps of 40 cp at $18.33 each per year, and 164 arc lamps at $84.08 each per year. It is said that under the new contract the city will save more than $800 per year.

Norton (Kan.) Light Property Sold.—A controlling interest in the Norton (Kan.) Light, Ice & Cold Storage Company has been sold to W. H. Marsh, of Norton. The company is contemplating the extension of its transmission lines to Almena, 12 miles, and the installation of an additional engine. It also may change the system from single to three phase.

Kellogg-Dean Combination Abandoned.—It is announced that the proposed consolidation of the Kellogg Switchboard & Supply Company, of Chicago, and the Dean Electric Company, of Elyria, Ohio, has not materialized and that the negotiations have been discontinued.

Financial Intelligence.

THE WEEK IN WALL STREET

The Wall Street market during the past week has been quite active, but extremely unsatisfactory. On Jan. 19, following the collapse of the Columbus & Hocking pool, the exchange witnessed almost a panic. Prices declined rapidly, and many stocks reached lower points than at any time during the past six months. Heavy financial interests at once came to the support of the market, and buying orders were liberally placed. This support naturally caused a recovery, which marked the closing days of the week; but on Jan. 24 there again appeared a disposition to sell, and much of the stock accumulated by those who bought to prevent a panic was unloaded. This caused another break, ranging from one to five points in the market, which especially affected the more active issues. The truth of the matter is that the market is in a nervous condition, due primarily to the uncertain attitude of the Government authorities concerning large corporations. Threats of prosecutions, of adverse legislation and the fear of Supreme Court decisions against the Standard Oil and American Tobacco companies all contributed to a feeling of uncertainty that might easily develop into demoralization. In addition to this, there is the possibility of labor troubles extending over the great Eastern railroads. At the present time there are very few people who are desirous of accumulating long lines of stock, and there seems to be many people who would like to get out of the market with the profits they now have. The money market continues to be fairly easy, and the banks are showing no disposition to curtail loans. Quotations on Jan. 24 were: Call, 3 @ 3½ per cent; 90 days, 4 @ 4¼ per cent. The quotations in the table are those of the close, Jan. 24.

NEW YORK.

	Jan. 17.	Jan. 24.	Shares sold.		Jan. 17.	Jan. 24.	Shares sold.
All. Ch.	14*	13¼*	4,100	Int.-Met., pfd.	61	56	97,100
All.-Ch., pfd.	50⅛	47¼	3,900	Mackay Cos..	85	89	2,500
Amal. Cop...	82¾	82½	240,050	Mackay C., p.	77	77	950
Am. D. T....	20½*	20½*	———	Man. Elev...	137	138*	850
Am. Loc.....	55¾	53¼	18,500	Met. St. Ry..	25*	25*	———
Am. Loc., pfd.	113¾	112	795	N.Y.&N.J.Tel.	139¼	139¼*	———
Am. Tel. & C.	76*	76*	———	Steel, com...	84	84¾	1,844,725
Am. T. & T..	137½	137¼	17,701	Steel, pfd....	123	123⅜	23,400
B. R. T.....	74⅝	72⅜	47,942	W. U. T.....	73½	72¼	6,600
Gen. Elec....	154½	153½	6,127	West'h., com.	72	73½	11,810
Int.-Met.,com.	24	21½	116,000	West'h., pfd..	128¼	128*	180

PHILADELPHIA.

	Jan. 17.	Jan. 24.		Jan. 17.	Jan. 24.
Am. Rys.....	48	47½	Phila. Elec.....	14	14⅛
Elec. Co. of A.....	12½*	12*	Phila. R. T.....	25½	26⅛
Elec. St. B'ty.....	61	59¼	Phila. Trac.....	83¾	88⅛
E. S. B'ty, pfd.....	30*	30*	Union Trac.....	51	51½

CHICAGO.

	Jan. 17.	Jan. 24.		Jan. 17.	Jan. 24.
Chi. City Ry.....	180*	180*	Chi. Tel. Co.....	130	130
Chi. Rs., Ser. 1.....	107½*	107½*	Met. El., com.....	17*	17*
Chi. Rs., Ser. 2.....	31*	31*	Met. El., pfd.....	53¼	54*
Com. Edison.....	120	118*	Nat'l Carbon.....	108¾	109
Chi. Subways.....	4⅞	4½*	Nat'l Car., pfd.....	122½*	121*

BOSTON.

	Jan. 17.	Jan. 24.		Jan. 17.	Jan. 24.
Am. T. & T.....	137¾	137¾	Mex. Tel.....	3½	4*
Cum. Tel.....	144*	147¼	Mex. Tel., pfd.....	6	6¼*
Edison E. Ill.....	243	241½	N. E. Tel.....	134½	136
Gen. Elec.....	154½	155	W. T. & T.....	16	16
Mass. E. Ry.....	18½	19*	W. T. & T., pfd....	93	90½*
Mass. E. R., pfd....	80	81			

* Last price quoted.
Shares sold are for week of Jan. 17 to Jan. 22.

Ohio Gas Companies Consolidated.—The directors of the Cleveland Gas Light & Coke Company and the People's Gas Light Company, of Cleveland, have merged the two properties into the East Ohio Gas Company. The capital stock of the latter company was increased from $15,000,000 to $20,000,000. The control of the East Ohio Gas Company is vested in the Columbia Gas & Electric Company, which already owns a number of Ohio gas properties and has offices at Cincinnati, Cleveland and Huntington, W. Va.

New York, New Haven & Hartford Earnings.—For the six months which ended Dec. 31, 1909, the gross earnings of the New York, New Haven & Hartford Railroad show a gain of about $3,300,000, or in the neighborhood of 12 per cent. There is a net gain, after paying taxes and all fixed charges, of about 35 per cent. The New Haven company is constantly adding to its electrical equipment, and has on hand many plans for the extension of its electrical zone.

New England Trolley Combination.—Another effort is being made to consolidate all of the street railway lines in Massachusetts west of the Connecticut River under the control of the New York, New Haven & Hartford Railroad. A bill with this object in view has been introduced in the Massachusetts Legislature. A similar bill was presented last year, but it could never be brought up for passage.

American Light & Traction Company.—The annual report of the American Light & Traction Company for the year ended Dec. 31, 1909, showed earnings of $3,033,668 on the stocks of the subsidiary companies for the year. This compares with $2,452,873 for the previous year. The total surplus, after payment of expenses, fixed charges and $1,299,585 in dividends on the stock, now amounts to $5,999,065.

Southern Wireless Telephones.—Application has been made at Atlanta, Ga., for a charter for the Southern Wireless Telephone & Telegraph Company with $1,000,000 capital. It is announced that the company plans to establish wireless stations in a number of Southern cities, with a central station in Atlanta. It is said that the company is backed entirely by Southern capital.

Fayetteville (N. C.) Gas & Electric Light Company.—The plant of the Fayetteville (N. C.) Gas & Electric Light Company was sold last week by order of the United States Court to Thomas Badger, Jr., who has been manager of the company for some time. The price paid for the property was $11,000.

Interborough-Metropolitan Company.—At the annual meeting of the stockholders of the Interborough-Metropolitan Company last week, Theodore P. Shonts, president of the company, announced that the Interborough was in a position, owing to the financial support which was offered it by J. P. Morgan & Company, to spend from $100,000,000 to $150,000,000 on new subways or in betterments of the service. At the office of J. P. Morgan & Company it was denied that Mr. Shonts had any authority to make such a sweeping statement. Mr. Shonts in his address to the stockholders took the ground that the Interborough had made reasonable propositions for improving the very unsatisfactory transit conditions of Manhattan, and that the Public Service Commission had refused to accept the company's proposals. In response to this W. R. Willcox, chairman of the Public Service Commission, issued a statement in which he said that the demands of the Interborough were unreasonable. Since then it is said that the Interborough has expressed willingness to modify its requirements. At the stockholders' meeting the financial report showed that the Interborough-Metropolitan Company for the year ended Dec. 31, 1909, had a total net income of $3,342,581. Interest on bonds, expenses and taxes were paid amounting to $3,372,276, leaving a net deficit for the year of $29,635. The earnings of the Interborough Rapid Transit Company have provided the sole source of income for the Interborough-Metropolitan Company, and the increase in its earnings has been enormous since July 1, 1909.

Western Telephone & Telegraph Company.—Kidder, Peabody & Company, of Boston, have bought $10,000,000 of the 5 per cent 2-year notes of the Western Telephone & Telegraph Company. These notes are dated Feb. 1, 1910, and are due Feb. 1, 1912. They are secured by the following collateral deposited with the Old Colony Trust Company, of Boston: $1,350,900 Northwestern Telephone Exchange Company stock, $5,587,600 Southwestern Telephone & Telegraph Company stock, $4,091,200 Wisconsin Telephone Company stock, $1,222,000 Cleveland Telephone Company notes, $5,422,000 Northwestern Telephone Exchange Company notes and $1,036,000 Southwestern Telephone & Telegraph Company notes. It is claimed that the aggregate value of these securities is almost $20,000,000. The underwriters are offering these notes to the public at 99½ and interest.

Toledo & Indiana Electric Railway Sold.—At the receivers' sale of the Toledo & Indiana Electric Railway Company's property in Toledo last week, the price was run up by contending interests to $1,058,500, which was an excess of $138,500 over the upset price set by the court. The property was bid in by S. C. Schenck, of Toledo, who represented a committee of the majority bondholders, including the Knickerbocker Trust Company, of New York. This company operates an interurban line from Toledo to Bryan, Ohio, a distance of about 56 miles.

Consolidated Traction Reorganization in Chicago.—In accordance with the plan for the reorganization of the Consolidated Traction Company, of Chicago, heretofore outlined in these columns, the Chicago United Railway Company was incorporated in Illinois on Jan. 14. The new company is licensed to construct and operate electric railways in the counties of Cook, Du Page, Lake, McHenry and Will. A new franchise will be sought from the city of Chicago and from the suburban towns through which the lines of the company extend.

Merger of Gas and Electric Companies in Indiana.—The properties of the Citizens' Water & Light Company, and the Shelbyville Gas Light Company, both of Shelbyville, Ind., have been sold to Ambrose Petty, of New York; Howard Olds, of Detroit; John T. Bacon, of Chicago, and M. O. Straight and F. C. Kelly, of Detroit. The plants of these two companies have been consolidated, and plans are being prepared for the construction of a large power plant which will combine the two properties and supply electricity, gas, heat and water.

Metropolitan Franchise Taxes.—Receivers Joline and Robinson of the Metropolitan Street Railway Company (New York) have asked the United States Circuit Court for instructions in regard to the payment of special franchise and other taxes levied against the corporation since 1901. They state that these taxes with the interest amounted on Dec. 31 to $5,234,972. The receivers believe that if these taxes can be paid at the present time, and the amount deducted from the gross earnings of the company, the result will be that the company will save a large amount in its tax bills.

DIVIDENDS

Amalgamated Copper Company, quarterly, ½ per cent, payable Feb. 28.

American Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Feb. 1.

Commonwealth Edison Company, Chicago, quarterly, 1½ per cent, payable Feb. 1.

Consolidated Car Heating Company, quarterly, 1½ per cent, payable Jan. 31.

Helena (Mont.) Light & Railway Company, preferred, quarterly, 1¼ per cent, payable Feb. 1.

Metropolitan West Side Elevated Railway, Chicago, preferred, quarterly ¾ per cent, payable March 1.

Mexican Tramways Company, quarterly, 1½ per cent, payable Jan. 31.

Pacific Gas & Electric Company, San Francisco, preferred, quarterly, 1½ per cent, payable Feb. 15.

Philadelphia Company, Pittsburgh, preferred, semi-annual, 2½ per cent, payable March 1.

Quincy (Ill.) Gas, Electric & Heating Company, 1 per cent, payable Jan. 25.

Railway & Light Securities Company, Boston, preferred, semi-annual, 3 per cent, payable Feb. 1.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
American Light & Traction Company:					
Year 1909	$3,345,440	$108,261	$3,239,179	$1,606,513	$1,606,513
Year 1908	2,723,064	45,000	2,678,064	1,349,254	1,328,810
Blackstone Valley Gas & Electric Company:					
Year 1909	985,773	503,112	482,661	.....	.....
Year 1908	871,461	472,045	399,416	.....	.....
Boston Suburban Electric Companies:					
December, 1909	57,216	51,763	5,453	13,752	*8,299
December, 1908	60,740	49,337	11,403	13,341	*1,938
Dallas (Tex.) Electric Corporation:					
Year 1909	1,320,121	821,491	498,630	287,811	160,819
Year 1908	1,169,967	780,655	389,312	348,025	41,287
El Paso Electric Company:					
Year 1909	600,958	573,920	27,038	9,410	17,628
Year 1908	534,222	516,328	17,894	7,855	10,039
Galveston-Houston Electric Company:					
Year 1909	1,206,543	709,033	497,510	223,899	233,611
Year 1908	1,088,447	587,973	460,474	245,278	215,196
International Railway Company, Buffalo:					
Quarter ended Sept. 31, 1909	1,390,889	719,995	670,893	217,567	396,600
Quarter ended Sept. 30, 1908	1,348,538	735,350	613,188	224,768	333,082
Minneapolis General Electric Company:					
Year 1909	1,108,756	464,076	644,680	366,885	277,795
Year 1908	1,008,415	432,935	575,480	382,000	193,480
Montreal Street Railway Company:					
December, 1909	337,563	212,006	125,556	344,480	91,076
December, 1908	304,885	203,119	101,766	30,726	71,039
Northern Texas Electric Company:					
Year 1909	1,250,550	743,735	506,815	144,139	362,676
Year 1908	1,080,577	630,052	450,525	189,541	260,984
Puget Sound Electric Railway Company:					
Year 1909	1,869,095	1,250,587	618,508	570,048	48,460
Year 1908	1,639,131	1,140,905	598,226	515,140	83,086
Seattle Electric Company:					
December, 1909	481,892	289,035	192,857	103,709	89,148
December, 1908	415,079	243,801	161,278	94,212	65,064
United Railways Company of St. Louis:					
December, 1909	918,328	601,491	316,837	232,176	84,661
December, 1908	910,288	555,430	354,858	233,866	120,992

*Deficit.

General News

Construction News.

BAY MINETTE, ALA.—It is reported that a proposition has been submitted to the town by Hampton D. Ewing, offering to erect a power plant to cost $10,000 if the citizens will guarantee the use of 500 lamps.

BIRMINGHAM, ALA.—At a recent meeting of the Birmingham Board of Trade a resolution favoring the municipal ownership of the water and lighting plants was adopted. A special committee was appointed to look into the matter and report at a later meeting as to what steps to take.

EUFAULA, ALA.—It is reported that the city is considering the construction of an electric light plant.

JACKSONVILLE, ALA.—We are informed that the Calhoun Light & Power Company will furnish electricity to operate and light the new mill now under construction in Jacksonville, which will require about 75 kw for motors and 300 incandescent lamps. O. H. Herring is manager.

RUSSELLVILLE, ALA.—Preparations are being made for the installation of an electric light plant in Russellville. George C. Thornton, president of the Russellville Manufacturing Development Company, is interested in the project.

CHICO, CAL.—The Sacramento Valley Power Company, it is said, will soon commence work on the erection of its transmission lines in Chico. A. V. Smith is secretary of the company.

ESCONDIDO, CAL.—The Escondido Utilities Company, which is erecting an electric plant in Escondido, is planning to extend its transmission lines to San Marcos and Richland to Twin Oaks, toward the Moosa Canyon country, to the east end of the Escondido Valley and to San Pasqual Valley, and also proposes to supply electrical service to residents along the line. The plans include an electric plant, gas plant, creamery and ice and cold storage plant, and will involve an expenditure of about $100,000. All of the equipment for the plants has been purchased and it is hoped to have the electric service in operation within 30 days. Seth Hartley is president of the company.

HOLLYWOOD, CAL.—The Board of Trustees has authorized an extension of four miles in the lighting service, including the installation of 80 lamps, service wire and tungsten lamps, at a cost of $11,600.

LONG BEACH, CAL.—It is reported that work will soon start on the construction of the large steam power plant of the Edison Electric Company in Long Beach. The equipment of the plant, it is said, will include two turbines with a rating of 15,000 hp each. It is understood that the plant will be located on the west side of the harbor, near the Craig shipbuilding plant, and will cost about $2,100,000.

LOS ANGELES, CAL.—A permit has been issued to the Los Angeles-Pacific Electric Railway Company for the erection of a substation at 560 Soto Street, Los Angeles, which will be used for the distribution of electricity for the street car service in that part of the city.

LOS ANGELES, CAL.—At a meeting of the stockholders of the Los Angeles Pacific Company, held Jan. 6, it was voted to issue $20,000,000 in bonds, $10,000,000 of which will be used for additions and improvements to its system. The remainder will be used to retire outstanding bonds.

OAKLAND, CAL.—The Southern Pacific Company has filed an application with the Board of Supervisors for a franchise to construct and operate an electric railroad from Albany to Berkeley as part of its interurban railroad system between Berkeley and San Francisco, Cal.

OAKLAND, CAL.—The People's Electric Light & Power Company has filed a revised application with the Board of Supervisors for a franchise for electric transmission lines through the County of Alameda for the transmission of electricity for heat and power. The changes were made necessary by the annexation election.

REDONDO BEACH, CAL.—It is reported that preparations are being made for extensions to the local electric system, which will double the output of the plant and involve an expenditure of $1,500,000.

RIVERSIDE, CAL.—The Supervisors have sold a 50-year franchise to the Beaumont Gas & Power Company, giving it the privilege of constructing and operating gas mains, and to erect transmission lines for the distribution of electricity for lamps, heat and motors, etc.

SACRAMENTO, CAL.—Preparations are being made by the Sacramento Gas, Electric & Railway Company for the construction of an underground conduit system in Sacramento for the purpose of placing its wires underground in the district lying between Fifth and Seventh, I and L streets. The work will be in charge of E. C. Holburton, chief engineer of the Pacific Gas & Electric Company.

MANITOU, COL.—The installation of an electric light plant in Manitou is under consideration.

MONTE VISTA, COL.—The Monte Vista Electric & Gas Lighting Company is contemplating increasing the output of its plant by the installation of a steam turbo-generator set with a rating of about 275 hp.

NEW BRITAIN, CONN.—The Board of Public Works is contemplating making extensions to the subway for placing overhead wires underground.

NEW LONDON, CONN.—The contract for furnishing electrical fixtures to be installed at Fort H. G. Wright, N. Y., has been awarded to the Reading Chandelier Works, Reading, Pa., for $2,250.

NORWICH, CONN.—Announcement has been made by the Norwich, Colchester & Hartford Traction Company that plans have been perfected for the construction of its proposed electric railway, which will commence at Norwich and join the Hartford railway system in Glastonbury. It is expected that work on the proposed railway will begin in the spring.

STRATFORD, CONN.—The New York, New Haven & Hartford Railroad Company is reported to have purchased a site in Stratford, Conn., for its proposed power plant, which will furnish electricity for operating its system from Stamford to New Haven. It is said that the plant will be equipped to supply power for the system as far north as Harford.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 1 for furnishing at the navy yards and naval stations the following supplies: Mare Island, Cal.: Schedule 2114—Furnishing and installing a 21-hp marine motor engine. Brooklyn, N. Y.: Schedule 2159—20 steam turbo-generator wireless telegraph sets. Boston, Mass.—Schedule 2160—68,000 lb. crucible cast-steel wire. Schedule 2164—2180 lb. sheet lead in rolls; 10,000 lb. rolled sheet zinc. Schedule 2165—1500 lb. rolled bronze rod. Applications for proposals should designate the schedules desired by number.

CARROLLTON, GA.—The Carrollton Electric Company, it is reported, will be in the market for a 250-hp engine in the near future.

SAVANNAH, GA.—The Savannah Hydro-Electric Company is reported to be making arrangements to construct a large hydroelectric power plant on the Cannochee River, near Savannah, at a cost of more than $500,000. The officers of the company are: S. K. Platshek, president; D. G. Zeigler, vice-president and general manager, and G. H. Miller, secretary and treasurer. The Savannah Hydro-Electric Company is successor to D. G. Zeigler & Company.

VALDOSTA, GA.—We are informed that the Consolidated Ice & Power Company expects to call for bids for the construction of its proposed electric plant about Feb. 15. The cost of the work is estimated at about $100,000. G. K. Kiser is president of the company.

WILLACOOCHEE, GA.—We are informed that nothing will be done in regard to the installation of lighting system in Willacooche before the latter part of this year. L. W. Summerlin is city clerk.

SALEM, ILL.—W. A. Monroe, superintendent of the municipal electric light plant, writes that it is proposed to install a water works system this spring. The project includes an impounding reservoir and a motor driven pump.

BROOK, IND.—Plans are being made by Gragg Brothers, owners of the local electric light plant, for increasing its generating equipment and transmission system. It is also proposed to install an additional 30-hp motor at Foresman, Ind., four miles distant.

BROOKVILLE, IND.—The Brookville Furniture Company is erecting an extension to its plant. The machinery in the new building will be equipped for electric motor drive, electricity for which will be provided by the new power plant now under construction.

CRAWFORDSVILLE, IND.—Steps have been taken by the trustees of the Crawfordsville Electric Light & Power Company toward the erection of a new electric-light plant in Crawfordsville. The trustees are said to have a sinking fund saved from the earnings of the present plant which will be used as a nucleus for the erection of the new plant.

EDINBURG, IND.—Preparations are being made by the managers of the municipal electric light plant to establish a 24-hour service and to install meters. New poles will be erected throughout the entire line. G. R. Mutz is superintendent.

INDIANAPOLIS, IND.—Steps have been taken by Mayor Shank toward the establishment of an electric-light plant to furnish electricity for lamps for the East Market, Tomlinson Hall and the new city hall, to cost approximately $100,000.

MONTICELLO, IND.—Considerable damage was done to the plant of the Tippecanoe Light & Power Company by the high water and ice gorge. A 300-hp engine has been installed to furnish power for the plant during the time the water wheels were submerged.

SHELBYVILLE, IND.—The plants and holdings of the Citizens Water & Light Company and the Shelbyville Gas Light Company have been sold to Ambrose Petty, of New York, N. Y.; Howard Olds, of Detroit, Mich.; John T. Bacon, of Chicago, Ill.; M. O. Straight, of Detroit, Mich., and F. C. Kelly. The plants have been consolidated, and plans are being prepared for the construction of a large building and combine the two plants to supply electricity, gas, heat and water.

BURLINGTON, IA.—Plans are said to have been prepared for the con-

struction of a power house for the Chicago, Burlington & Quincy Railroad in Burlington, Ia. The plant would furnish electricity for lighting the Union Station, the round house, freight yards and for motors.

CEDAR RAPIDS, IA.—The Cedar Rapids & Iowa City Railway & Light Company has announced a reduction in its rates for electrical service amounting to 16⅔ per cent, of which half will be effective from Jan. 1, and the entire reduction will go into effect July 1, 1910.

DES MOINES, IA.—Bids will be received by the Supervisors of Des Moines County at Burlington, Ia., until Feb. 17 for furnishing and erecting a complete pumping station, including building and machinery, for the Des Moines County Drainage District No. 1. The equipment is to consist of two or three centrifugal pumps, each direct connected to a cross or tandem-compound condensing Corliss or four-valve steam engine; three water-tube boilers for a working pressure of 150 lb. per square in., equipped with superheaters for a working temperature of 475 degrees; one small vertical auxiliary boiler for working pressure of 100 lb.; shaking grates, induced draft, duplicate feed-water system, open heater; electric-lighting system for the plant, and a coal tramway electrically operated. For further information, plans and specifications address the Harman Engineering Company, 120 Fredonia Avenue, Peoria, Ill.

POCAHONTAS, IA.—At an election held recently the proposition to construct a municipal electric light plant, at a cost not to exceed $14,000, was carried. George Schnieders is town clerk.

CHERRYVALE, KAN.—The Cherryvale Electric Light & Power Company is contemplating increasing the equipment of its power plant by the installation of a 200-hp gas engine and gas producer. It also proposes to install a series tungsten lamp street lighting system. C. A. Martin is manager.

COLBY, KAN.—At an election to be held Jan. 28 the proposition to issue bonds for the construction of an electric-light plant and water-works system will be submitted to a vote. Plans for the plant have been prepared by Burns & McDonnell, consulting engineers, 821 Scarritt Building, Kansas City, Mo. The cost of the work is estimated at $55,000.

ERIE, KAN.—Bids will be received by the City of Erie until Feb. 17 for construction of waterworks, electric light plant and sewers. Burns & McDonnell, 821 Scarritt Building, Erie, Kan., are consulting engineers. J. C. Denious, city clerk.

MADISON, KAN.—Plans are being considered by the Madison Light & Ice Manufacturing Company for changing its system from direct to alternating-current, which will include the installation of a new boiler, engine, generator and transformers. F. L. Krueger and B. F. Yonker are owners of the plant.

NORTON, KAN.—The controlling interest of the Norton Light, Ice & Cold Storage Company has recently been purchased by W. H. Marsh, of Norton, Kan. The company is contemplating the extension of its transmission line to Almena, 12 miles distant, and the installation of an additional engine and may possibly change the system from single to three-phase. W. R. Tasker is manager.

LOUISVILLE, KY.—The contract for the electric wiring for the new Avery plant under construction in South Louisville has been awarded to F. A. Clegg & Company, of Louisville, Ky.

BALTIMORE, MD.—Samuel T. Williams, 223 North Calvert Street, Baltimore, Md., is reported to be in the market for an 18 to 22-kw, 220-volt generator (belted), with switchboard; also a generator and engine, direct connected, of a proper rating to provide for 100 lamps.

INDIAN HEAD, MD.—Bids will be received until Feb. 8 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing and installing power plant equipment at Indian Head.

EAST BOSTON, MASS.—Arrangements are being made to drive the machinery of the Maverick mills by electric motors. The contract for electrical machinery, which has been awarded to the Allis-Chalmers Company, includes a 1500-kw, 1800 r.p.m.; 60-cycle, three-phase, 600-volt condensing steam turbo-generator set. A 15-kw motor generator set and a 15-kw engine-driven exciter are provided for excitation. A four-panel switchboard will also be provided. Four 100-hp and seven 150-hp induction motors will drive the looms.

EASTHAMPTON, MASS.—The Easthampton Gas Company is reported to be contemplating the installation of a new steam power plant.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company is planning to erect a new building in the spring and install a 750-kw General Electric horizontal turbine. George W. Lawrence is superintendent.

WALTHAM, MASS.—The city has entered into a contract with the Edison Electric Illuminating Company, of Boston, for lighting the streets and public buildings for a term of 10 years, beginning Sept. 1, 1909. Under the terms of the contract the company is to furnish 506 tungsten lamps of 40 cp at the rate of $18.33 each per year, and 164 arc lamps at $84.08 per lamp per year for all-night and every-night service. Under the new contract the city will save about $805 per year. In our issue of Jan. 6 the price for incandescent lamps was given as $10.80 each per year, and arc lamps $36 per lamp per year, which is simply a fixed charge for the lamps and does not include the running cost.

WINCHENDON, MASS.—Surveys and estimates are being made by the Winchendon Electric Light & Power Company for the construction of a large dam near the Hurley estate, with a view of increasing the output of its plant. William M. Whitney is president of the company.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company has engaged J. G. White & Company, of New York, N. Y., to prepare plans for a new power plant with an output of 40,000 hp. The site for the power station has not yet been decided upon. Several new substations will also be erected.

BAY CITY, MICH.—The Mershon-Bacon Company has placed an order with the Allis-Chalmers Company, Milwaukee, Wis., for a 200-kw, 600-volt, 60-cycle, three-phase, 900 r.p.m. alternator for belt connection to an engine; also a 9-kw belted exciter and a two-panel switchboard.

DUNDEE, MICH.—The Dundee Hydraulic Power Company has applied to the Railroad Commissioners for permission to issue $10,000 in bonds, the proceeds to be used for the construction of a water-power plant at Dundee.

MENDON, MICH.—At an election held Jan. 17 the proposition to purchase the Stofflet mill dam at Parkvale to operate the municipal electric-light plant was carried by a large majority.

ELYSIAN, MINN.—Application has been made to the Village Board by the Cannon Valley Electric Light & Power Company for a franchise to furnish electricity in Elysian.

MINNEAPOLIS, MINN.—The directors of the Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company have voted to appropriate $650,000 for the construction of the first section of track from Minneapolis to Northfield, a distance of 45 miles. The railway, when completed, will extend from Minneapolis, Minn., to Dubuque, Ia., a distance of 293 miles. M. W. Savage is president of the company and F. G. L. Hunt is engineer in charge.

VIRGINIA, MINN.—On Jan. 1 the Virginia Electric Power & Water Company put in operation its new power equipment, including a 375-kw, low-pressure turbine direct-connected to a 2300-volt, 60-cycle, three-phase alternator, which was installed by the Allis-Chalmers Company, Milwaukee, Wis.

SAVANNAH, MO.—Preparations are being made for extensive improvements to the municipal electric light plant as soon as the weather will permit, bonds for which have been voted. Arrangements have been made to secure electricity to operate the system from the St. Joseph Light, Heat & Power Company, of St. Joseph, Mo. The present plans call for rebuilding transmission lines, installation of new transformers and motors, and also installing motor for operating the pumping station. The work is expected to be completed about July 1. T. H. Lawrie is superintendent.

SLATER, MO.—Plans are being prepared by Burns & McDonnell, 821 Scarritt Building, Kansas City, Mo., for the reconstruction of the municipal electric-light plant and water-works system, to cost approximately $31,000.

GREAT FALLS, MONT.—H. C. Allen, city engineer, in his annual report to the City Council recommends the installation of a new and up-to-date street lighting system for the city, and also advises the city to assume entire control of regulating the design and arrangement of any system contemplated.

WHITEFISH, MONT.—The Big Bend Light & Power Company, which owns and operates the electric light and telephone system in Whitefish, is reported to have sold its property to the Northern Idaho & Montana Power Company.

CHADRON, NEB.—The City Council is considering the question of purchasing the electric plant of the Chadron Electric Light & Power Company to be operated as a municipal plant. Extensions are also contemplated if the plant is taken over by the city.

MINATURE, NEB.—The question of installing an electric lighting system in Minature is under consideration.

GOLDFIELD, NEV.—Plans are being prepared by the Tonopah & Goldfield Railroad Company for the erection of repair shops at Goldfield, Nev. Electricity will probably be secured from the hydroelectric plant at Bishop's Creek.

DERRY, N. H.—Preparations are being made by the Derry Electric Light Company to establish a 24-hour service for lamps and motors about Feb. 1, 1910. D. F. Griffiths is superintendent.

PASSAIC, N. J.—Orders have recently been placed by the Passaic Cotton Mills with the Allis-Chalmers Company for an 18 x 28 x 36 heavy-duty, cross-compound, non-condensing engine, which will be direct-connected to a 250-kva, 240-volt, three-phase, 60-cycle, 120 r.p.m., revolving field alternator and will also be supplied with a belt flywheel, designed to transmit about 200 hp to a line shaft, the normal rating of the engine being about 500 hp. A 17-kw belted exciter is also included.

BINGHAMTON, N. Y.—The Common Council has appointed a committee, consisting of Aldermen P. J. Hastings, T. J. McNamara, R. W. Sampson, city engineer; John A. Giles and Corporation Counsel Burr W. Mosher, to investigate the question of establishing a municipal electric light plant.

COHOES, N. Y.—A contract has been placed by the Fuld & Hatch Knitting Company with the Allis-Chalmers Company, Milwaukee, Wis., for a 600-kw, 3600 r.p.m., 480-volt, 60-cycle, three-phase condensing steam turbo-generator set.

ELIZABETHTOWN, N. Y.—The Elizabethtown Terminal Railroad Company has applied to the Public Service Commission, Second District, for permission to issue a first mortgage for $175,000 and for authority to issue bonds to the amount of $150,000 and $50,000 in capital stock, the proceeds to be used for construction of its railroad from Westport to Elizabethtown, a distance of about eight miles.

ROCHESTER, N. Y.—The Yawman & Erbe Manufacturing Company, it is reported, will install additional electrical equipment.

WHITESVILLE, N. Y.—A franchise has been granted to the Whitesville Light & Power Company to construct and operate an electric light plant in Whitesville. J. R. Williamson is reported interested in the project.

WILSON, N. Y.—At an election held Jan. 15 the proposition to light the village by electricity was carried.

WOLCOTT, N. Y.—George Tator, of Wolcott, is securing rights-of-way for an electric railway from Red Creek to this town, connecting at Wallington, three miles east of Sodus, with the Rochester & Sodus Bay electric railway. It is also stated that rights-of-way are being secured from Port Byron to Wallington via Plainville, Meridian, Cato, Victory, Westbury, Red Creek, Wolcott, North Rose and Alton. The Beebe interests are reported to be behind the project.

ALBEMARLE, N. C.—Bids will be received by I. B. Miller, Mayor, until Feb. 15 for the installation of an electric-light plant according to plans and specifications on file at the office of the Mayor. J. M. Bandy, of Greensboro, N. C., is engineer.

CHARLOTTE, N. C.—Preparations are being made by the Piedmont Buggy Company for the erection of a new plant 65 ft. x 225 ft., three stories high. The machinery will be equipped for electric motor drive.

GASTONIA, N. C.—Surveys have been completed by the Piedmont Traction Company for its proposed electric railway, 13 miles in length, to connect Gastonia and Mount Holly. As yet only one contract has been awarded for grading the road. T. C. Lee is engineer. W. S. Lee and Louis Harrison are incorporators.

TYRON, N. C.—Preparations are being made for the construction of a hydroelectric power plant on the Pacolet River, near Tyron, N. C., for which water rights have been secured. The proposed plant will furnish electricity for lamps and motors in Tyron and surrounding towns. W. C. Blackmon, of Tyron, N. C., is engineer.

ASHLAND, OHIO.—We are informed that the Ashland Gas & Electric Light Company is contemplating the construction of a new power plant in the spring. S. N. Blake is manager.

CEDARVILLE, OHIO.—The capital stock of the Cedarville Light & Power Company has been increased from $10,000 to $20,000.

CLEVELAND, OHIO.—Preparations are being made by the Kelly's Island Lime & Transport Company for the installation of a large line of electrical apparatus in connection with its properties at Martin's Station.

CLEVELAND, OHIO.—Plans are being made by the Cleveland Electric Illuminating Company for the construction of a large power plant at the foot of East Seventieth Street in the spring. Application has been made to the War Department for authority to build a bulkhead and intake channel in the lake at this point to supply the proposed plant with water for boilers and steam condensers. The plant will be installed on the one unit plant and will have an output of 150,000 hp, and will be operated in connection with the present plant.

DAYTON, OHIO.—Plans are being prepared by the C. W. Raymond Company for the construction of a new shop in Dayton, Ohio, the equipment of which will include engine, dynamos, motors, pneumatic apparatus, etc.

RISING SUN, OHIO.—Plans are being prepared for the erection of transmission lines for the distribution of electricity in Rising Sun, the cost of which is estimated at about $4,000. Estimates are wanted on wire, tungsten lamps, meters, transformers and switches. E. E. White and T. J. Martin are members of Board of Public Affairs.

SPRINGFIELD, OHIO.—The Oscar Lear Motor Company is contemplating the construction of a plant in Springfield, Ohio, which will be equipped for electric motor drive. An engine, generator and a large line of tools will be required soon.

SPRINGFIELD, OHIO.—A new plant is being erected by the Lagonda Manufacturing Company for the production of boiler cleaning apparatus, for which it is said that considerable apparatus will be needed. The machinery will be equipped for electric motor drive.

MOUNTAIN VIEW, OKLA.—It is stated that plans are being prepared for the installation of an electric light plant in Mountain View.

RALSTON, OKLA.—Bids will be received by the City of Ralston, Okla., for the construction of an electric light plant and water works system until Feb. 7, plans and specifications for which are on file at the office of the city clerk. Bids will also be received for $25,000 in bonds at the same date. M. A. Earl & Company, of Muskogee, Okla., are engineers. T. E. Bryant is city clerk.

SHAWNEE, OKLA.—The Shawnee Electric Railway Company, which proposes to construct an interurban railway from Oklahoma City to Shawnee and thence to Muskogee, has filed an amendment to its charter increasing its capital stock from $100,000 to $1,200,000. C. T. Edwards and A. Hargrave, of Shawnee, Okla., are among the directors.

EUGENE, ORE.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 10 for furnishing lighting fixtures for the U. S. public building at Eugene, Ore. James Knox Taylor is supervising architect.

GRESHAM, ORE.—It is reported that the Columbia Brick Company is in the market for alternating-current motors and other electrical equipment.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has recently placed a contract with the Allis-Chalmers Company for a 3750-kw, water-wheel type, 11,000-volt, 60-cycle, three-phase, 360 r.p.m. alternator; a 50-kw, 120-volt exciter will be direct-connected to an extension of the alternator shaft.

SALEM, ORE.—Governor Benson has authorized an appropriation made for the installation of an electric lighting system in the State penitentiary in Salem, Ore.

BEAVER FALLS, PA.—Preparations are being made by the Pittsburgh & Lake Erie Railroad Company for the construction of an electric light and power plant in Beaver Falls, work on which will begin next spring. The plant will furnish electricity for arc and incandescent lamps for the passenger station, freight depots and yards from Beaver Falls to the Ohio River, and also to light the large bridge now being erected across the Ohio River at Beaver.

EMPORIUM, PA.—Plans are being considered by the Borough Council for enlarging the municipal electric light plant during the coming summer for the purpose of increasing the commercial lighting service. The equipment will include a 150-hp gas engine, one 150-kw, three-phase, 60-cycle generator, transformers and meters. Robert Green is manager.

EVANS CITY, PA.—The Evans City Light, Heat & Power Company, recently incorporated, is planning to install its plant and erect transmission lines in Evans City, work on which will begin at once. R. A. Todd, A. C. Frey and S. A. Roelofs are interested in the project.

HARRISBURG, PA.—Arrangements are being made by the Pennsylvania Railroad Company for the installation of a Corliss engine and generator at the Harrisburg terminal.

LUCERNE, PA.—Preparations are being made by the Rochester & Pittsburg Coal & Iron Company for handling the output of its mines at Lucerne, Pa. The equipment will include a power and compressor plant, electric motors, etc.

PHILADELPHIA, PA.—The United Light & Power Company has filed a notice with the Secretary of State of an increase in capital stock from $5,000 to $100,000 and an issue of $400,000 in bonds. W. T. Meaney is treasurer of the company.

PITTSBURGH, PA.—The County Commissioners have awarded the contract for the electrical supplies for the Soldiers' Memorial Hall to the Iron City Engineering Company, of Pittsburgh, for $44,832.

PITTSBURG, PA.—Arrangements are being made by the Rochester & Mars Street Railway Company to begin construction on its proposed electric railway, which is to connect Rochester, Beaver and Butler in the near future. The railway will be 17 miles in length.

WAYNESBORO, PA.—Negotiations have been closed whereby the plant and holdings of the South River Light & Power Company have been purchased by a syndicate headed by J. R. Weaver, owner of the South River flouring mills. It is reported that the consideration was $9,000. It is understood that the new owners propose to enlarge the plant and extend the service.

WEST PITTSTON, PA.—Application will be made to the Governor of Pennsylvania on Feb. 1 by Joseph L. Dunn, Thomas J. Connelly and Edward J. Loughran for a charter for a street railway to be known as the West Pittston Street Railway Company, which proposes to construct and operate a street railway in the Borough of West Pittston, Pa.

BRANCHVILLE, S. C.—Messrs. Sabin & Morrison, of Branchville, S. C., are reported to be in the market for complete equipment for a small electric plant with sufficient output to supply about 50 lamps, including small engine and all apparatus for operation. Direct-connected machinery preferred.

SUMTER, S. C.—The Sumter Telephone Manufacturing Company is planning to install an electric power plant to furnish electricity to operate its factory.

HURON, S. D.—The Huron Light & Power Company will install a new arc lighting system, to provide for 50 lamps, in the spring, and is now ready to place contracts for the same. Coler Campbell is secretary and manager.

CHATTANOOGA, TENN.—Plans are being prepared by the Chattanooga Chair Manufacturing Company for the construction of a factory with wood-working machinery, which will be equipped for electric motor drive.

CHATTANOOGA, TENN.—The Rhea County court has granted D. J. Duncan a franchise to operate a trackless trolley over the main valley road from the Hamilton County line to Rhea Springs. The Hamilton County court also granted Mr. Duncan an extension of time on his former franchise. The City Council of Dayton has also granted him a right-of-way through the corporate limits of that town.

CLARKSVILLE, TENN.—Plans are being considered for increasing the plant of the Clarksville Electric Light & Power Company. It is understood that the installation of a turbo-generator set is under consideration.

LONSDALE, TENN.—The Council is reported to be considering the installation of a street lighting system in Lonsdale.

ELGIN, TEX.—It is reported that K. F. Leggett, of Livingston, Tex., is contemplating the erection of an electric-light plant in Elgin, Tex.

BRYAN, TEX.—It is reported that the executive committee, representing the citizens of Bryan, has accepted the proposition of O. E. Gammill,

of Gueyden, La., to construct the proposed electric railway from Bryan to College Station, a distance of five miles.

EL PASO, TEX.—Sealed proposals will be received until Feb. 3 by Percy M'Gee, city clerk, until Feb. 3 for the construction and erection of a refuse incinerator, steel stack and sewage pumping station equipment with appurtenances for the city of El Paso, Tex. The equipment will include one three-gate top charged incinerator with a capacity of 48 tons of wet weather refuse per 24 hours, two horizontal, 125-hp water-tube boilers, two direct-connected engine-driven, direct-current, 65-kw generating sets, three direct-connected motor-driven vertical centrifugal pumping units each having a capacity of 2,000,000 gal. per 24 hours, one one-ton, three-motor electric traveling crane, one self-supporting steel stack 4 ft. 6 in. in internal diameter and 70 ft. high above the base, a four-ton platform wagon scale, ventilating apparatus, preheater for the incinerator, together with the necessary refuse boxes, flues, tools, instruments, valves, pipes, wires and other appurtenances. Plans and specifications are on file at the office of F. H. Todd, city engineer, from whom copies may be obtained on payment of $10. Plans and specifications may also be seen at the office of Hering & Fuller, consulting engineers, 170 Broadway, New York, N. Y. Proposals must be made on blanks, which can be obtained from the city engineer.

HEREFORD, TEX.—J. A. King, manager of the Hereford Electric Light & Power Company, writes that the company has just installed a new 100-kw, General Electric generator, switchboard, etc., and established a day service.

HOUSTON, TEX.—The County Commissioners have awarded the contract for furnishing electric fixtures for the new court house to the Horn & Brannen Manufacturing Company, of Philadelphia, Pa., for $15,575.

ORANGE, TEX.—Application has been made to the City Council by the Orange Electric Railway Company for a franchise to operate a street railway system in this city.

ORANGE, TEX.—The Yellow Pine Paper Company is reported to have awarded a contract to T. W. Ellis, of Orange, Tex., for the construction of power house for its proposed electric-light and power plant.

SAN ANGELO, TEX.—The City Council has granted the San Angelo City Railway Company a 35-year franchise for extension of its system on the principal streets of the city.

SAN ANTONIO, TEX.—Surveys have been completed by the Metropolitan Steam & Electric Railway Company for its proposed electric railway between San Antonio and New Braunfels, Tex., a distance of 30 miles. Surveys are also being made for other lines contemplated by the company. It is said that the work has been financed and that work on construction of the road will soon commence. The company was recently organized to construct a system of interurban railways in South Texas, the first of which will extend from San Antonio and Austin via New Braunfels, about 85 miles in length. A line from New Braunfels to Gonzales via Seguin, 60 miles long, will be built. It is planned to eventually extend the railway to Houston, Tex. E. L. Squire, of Wilmington, Del.; John G. Marmion, of San Antonio, Tex., and M. Kauffman, of Yorktown, Tex., are among the stockholders of the company.

SHERMAN, TEX.—The Merchants & Planters' National Bank, of Sherman, Tex., it is reported, would like to receive estimates on electrical machinery for a five-story building.

UVALDE, TEX.—The Uvalde & Leona Valley Interurban Railway Company will soon commence work on construction of its proposed interurban railway to connect Uvalde and Batesville, a distance of about 30 miles. The railway will be operated either by electricity or gasoline motors. Charles Paterson is president.

OGDEN, UTAH.—Plans are being prepared by the Ogden Rapid Transit Company for the extension of its system from Hot Springs to Brigham City, a distance of about 12 miles. Later it is expected to extend the railway from Brigham City north through Box Elder County.

BRATTLEBORO, VT.—Announcement has been made by the Twin State Gas & Electric Company that a reduction will be made in the price of electricity, the new rates to take effect this month, a schedule for which will soon be issued.

PULASKI, VA.—Preparations are being made for extensions and improvements to the municipal electric-light plant, which will include the installation of a 150-hp boiler, 150-hp engine and a 105-kw generator, changing the system from 133 cycles, single-phase to 60 cycles, three-phase. When completed the plant will have an output of 180 kw in two units. S. S. Wall is superintendent of light and water departments.

RICHMOND, VA.—The contract for erecting the transmission line from the new municipal electric plant to the city water pumping station was awarded Jan. 17 by the council committee on water to the Carolina Construction Company, of Raleigh, N. C., for $8,995.

CHEWELAH, WASH.—Plans are being considered for increasing the output of the municipal electric-light plant which will involve an expenditure of about $10,000. It is proposed to develop more power by laying about 1½ miles of new pipe line by which a fall of 300 ft. will be obtained, whereas the present head is only 130 ft. Other changes will be made, but as yet plans have not been fully decided upon. L. R. Kimmel is superintendent.

HANFORD, WASH.—The Hanford Irrigation Company, it is reported, will expend $1,000,000 within the next 18 months in developing its hydroelectric plant at Priest Rapids, and extending its canals for irrigation purposes.

KENT, WASH.—Surveys are being made by the Valley Railroad & Power Company, recently incorporated, for its proposed electric railway from Kent, Orillia, O'Brien and Renton. The company is capitalized at $300,000. H. B. Madison, of Kent, Wash., is president. A. T. West, of Seattle, Wash., manager of the Independent Telephone Company of the White River Valley, is to be general manager.

PROSSER, WASH.—Harry C. Benson, secretary and manager of the Prosser Power Company, writes that it is expected to have the first unit, 600 hp, of the new plant in operation by June 1, 1910.

SEATTLE, WASH.—The Seattle Electric Company is contemplating the construction of 20 miles of new track during 1910. E. C. Guamnitz is purchasing agent.

SPOKANE, WASH.—Bids have been called for by the People's Portland Cement Company for the construction of steel and concrete buildings and machinery for a 2000-bbl. cement plant to be erected at Squaw Bay, a short distance from Spokane, Wash. The machinery required will include rotary kilns, tube mills, ball mills or kominutors, coolers, engines, generators, motors, crushers, etc.

TACOMA, WASH.—Bids will be received at the office of the Commissioner of Public Works, Room 203, City Hall, Tacoma, Wash., until Feb. 21 for construction of headworks and tunnel for a hydroelectric power plant on the Nisqually River. The work will include a concrete diverting dam, intake and settling channel, with necessary screens and gates, and a concrete-lined tunnel 10,015 ft. long. Plans and specifications may be obtained from the office of the chief engineer, room 303, City Hall, Tacoma, Wash., upon a deposit of $50, which will be refunded when plans are returned. Plans and specifications are on file for inspection at the office of the *Electrical World*, 239 West Thirty-ninth Street, New York, N. Y. Frank C. Kelsey is chief engineer, and H. J. McGregor, commissioner of public works.

MORGANTOWN, W. VA.—Plans are being made by the Morgantown & Dunkard Valley Railroad Company for building about 17 miles of new track in 1910 to connect West Morgantown, Riverside and Randall. J. A. Martin is purchasing agent.

MORGANTOWN, W. VA.—The county court has granted the Buckhannon & Northern Railroad Company a franchise to construct an electric railway on the county roads. An agreement has also been entered into between the Buckhannon & Northern company and the Morgantown & Dunkard Valley Railroad Company, whereby their differences of the right to use certain highways are adjusted. It is said that the last-named company will go ahead with its construction work and will form a link in the chain of electric railways between Morgantown and Pittsburgh.

SHERIDAN, WYO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 10 for supplying light fixtures for the U. S. public building at Sheridan, Wyo. James Knox Taylor is supervising architect.

SHERIDAN, WYO.—The Chamber of Commerce has appointed a committee to consider a proposition submitted by E. F. Wheaton, secretary and general manager of the General Traction Development Company, of Cleveland, Ohio, for the organization of a company to construct an electric railway to connect Sheridan and Buffalo, 40 miles in length. The citizens of Sheridan are asked to subscribe to $10,000 in stock.

EAU CLAIRE, WIS.—A. E. Peirce, Jr., of Eau Claire, Wis., assistant manager of the Chippewa Railway, Light & Power Company, writes that the company proposes to build a 50-ft. concrete dam and power house, to be located on the Red Cedar River at Cedar Falls, Wis. The equipment of the power house will include four 2000-kw generators.

HUSTISFORD, WIS.—The Milwaukee-Western Electric Railway Company, it is reported, will soon award contracts for the construction of a 200-hp steam-driven electric power plant in Hustisford. For further information address W. D. Chapman, engineer, Marquette Building, Chicago, Ill. The office of the company is located in the Majestic Building, Milwaukee, Wis.

MILWAUKEE, WIS.—The capital stock of the Milwaukee-Western Railway Company has been increased from $200,000 to $1,000,000. It is said that the company proposes to apply to the State Railroad Commission for permission to issue bonds. The company is planning to construct an interurban railway from Milwaukee to Green Lake, about 81 miles in length. Valentine Zimmerman, Jr., is president of the company, and J. W. Barer, secretary.

PHILLIPS, WIS.—It is reported that the John R. Davis Lumber Company is contemplating rebuilding its power plant. For further information address John R. Davis, of Phillips, Wis.

CALGARY, ALTA, CAN.—City Engineer Child in a recent report submitted to the Commissioners recommends the installation of a new power plant without delay and suggests a site in Victoria Park.

EDMONTON, ALTA., CAN.—The city of Edmonton is reported to have engaged Walter J. Francis, of Montreal, Que., Can., consulting engineer, to make a report on the power plant and other civic utilities.

MEDICINE HAT, ALTA., CAN.—Arrangements are being made by the Alberta Clay Products Company for the installation of a 500-hp power plant, the equipment of which will include three tubular boilers, Corliss engine, generator, pumps, heater, etc.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company has awarded a contract to Charles C. Moore & Company, of Seattle, Wash., for the construction of an auxiliary steam power plant at Van-

couver. The cost of the plant is estimated at $250,000. An order has been placed with the Allis-Chalmers Company, of Milwaukee, Wis., for two 2000-kw turbo generator units.

BLIND RIVER, ONT., CAN.—Preparations are being made by the Blind River Light, Heat & Power Company for extensive improvements and additions to its system during 1910, which will include the construction of a new concrete power house and installation of an additional 300-hp turbine. Thomas H. Pindell is superintendent.

BRIDGEBURG, ONT., CAN.—The Canadian Niagara Power Company is contemplating the construction of a power plant at Bridgeburg, at a cost of $60,000. The equipment of the station will include transformers, switches and distributing circuits to be erected early in the spring.

BURFORD, ONT., CAN.—E. A. Burgis, vice-president of the Burford Electric Heat, Light & Power Company, writes that improvements have recently been made to the plant, including the purchase of water power and the installation of a new wheel, new flume, etc. The plant will be sold to any party who will guarantee to keep it up to the standard and furnish a good service. The value of the plant is estimated at $9,000.

HESPELER, ONT., CAN.—Plans are being considered to take electrical service from Niagara Falls, through the Hydro-Electric Power Commission, about May 1. It is proposed to install a synchronous motor to replace the present steam plant, which will be held as an auxiliary. When the change is made a power service will be established. W. Brewster is treasurer.

LONDON, ONT., CAN.—The Colonial Engineering Company, of Monteral, Que., has offered to furnish electricity for lighting the streets of the city at the rate of $40 per lamp per year. The company also offers to sell to the city for use in its combination lighting and pumping works a plant in which gas producer will be used.

LONDON, ONT., CAN.—It is reported that new bids will be called for electrical equipment at the power station, the former specifications, it is said, having contained too many alternatives. The apparatus required includes transformers, motor-generator set, voltage regulators, switchboards, lighting protectors, instruments, arc and incandescent street lighting equipment. E. I. Sifton is chief electrical engineer.

MIDLAND, ONT., CAN.—Bids will be received until Feb. 1 for hydraulic equipment for generating station at Big Chute, Severn River, by W. Finlayson, secretary, Simcoe Railway & Power Company, Midland, Ont., as follows: Hydraulic equipment, penstocks, electrical equipment for 27 miles of transmission line, wire, insulators, crossing towers, etc.; also electrical equipment for receiving station at Midland, Ont. C. H. & P. H. Mitchell, Traders Bank Building, Toronto, Ont., are consulting engineers.

PORT ARTHUR, ONT., CAN.—The injunction applied for by the Ontario & Michigan Power Company to prevent the execution of the agreement between the Town of Port Arthur and the Hydro-Electric Power Commission, endorsed at the municipal election on Jan. 3, was dismissed by the trial judge Jan. 13. This decision left the town free to conclude the arrangement, and the agreement has been executed by the Mayor and city clerk. Under the terms of the contract the Hydro-Electric Power Commission is to furnish 1000 hp at the rate of $17.50 per hp per year; the town is to pay for 990 hp, whether used or not; after the delivery of 990 hp the town is to pay for at least 90 per cent of all power on order. Beyond 90 per cent, if the power taken at any time during a month exceeds this amount, reaches 15 consecutive minutes' duration, the corporation pays for this increased amount over and above the 90 per cent as a penalty, but during that month only.

WOODSTOCK, ONT., CAN.—J. G. Archibold, manager of the municipal electric light system, writes that material changes will be made to the plant during the next six months to prepare for operating the system with electrical energy from Niagara Falls, which will be supplied through the Hydro-Electric Power Commission of Ontario. Contracts have been awarded for transformers, synchronous motor, etc.

MONTREAL, QUE., CAN.—The City of Maisonneuve has entered an action against the Royal Electric Company and the Montreal Light, Heat & Power Company for the annulment of their contract on the ground that the lamps furnished the city do not meet the requirements covered by the contract. This action is the outcome of a disagreement between the company and the municipality over the lighting system. The company claims an exclusive franchise over the streets and started an action some time ago to obtain an injunction to prevent the Dominion Light, Heat & Power Company from erecting transmission lines and furnishing service in the city. The action was dismissed by the courts. The city claims that the contract calls for 2000-cp arc lamps and that the present lamps are much below the standard. It is also claimed that the contract made with the old Royal Electric Company has 10 years yet to run at the rate of $115 per lamp per year, which it is claimed is an excessive price. The city also claims that the whole contract is illegal and ultra vires of the Maisonneuve Council on the ground that the contract was accepted by a resolution of the Council only, whereas a by-law should have been passed. It is further claimed that the Montreal Light, Heat & Power Company is bound to furnish electricity for lamps to residents and factories, but has refused to do so. It is expected that the entire question will come before the superior court as to the rights of the Montreal Light, Heat & Power Company and the rights of the City of Maisonneuve with regard to granting the Dominion Light, Heat & Power Company a franchise to erect its transmission lines in the municipality.

CHAMAL, TAMAULIPAS, MEX.—The question of establishing a municipal electric plant in Chamal is under consideration.

GUADALAJARA, MEX.—Preliminary steps have been taken by the Chapala Hydro-Electric & Irrigation Company for the construction of an electric railway between this city and Aguascalientes, a distance of about 120 miles. The company is preparing to extend its transmission lines over a large territory to furnish electricity in the mining districts of this State. The company also proposes to construct an electric railway from Guadalajara to the pleasure resorts on Lake Chapala, work on which will begin as soon as the plans have been approved by the Government. The proposed railway will be about 35 miles in length.

MONTEREY, MEX.—The government of the State of Nuevo Leon has approved the plans of the Monterey Railway, Light & Power Company for extending its railway system in several directions. It is proposed to give transportation facilities to the larger manufacturing and industrial plants in the outskirts of the city.

PACHUCA, HIDALGO, MEX.—The State Government of Hidalgo has granted a concession to the Compania Empressa Irrigador de la Vaga de Metzitlan of Pachuca for the erection of a hydroelectric power plant and the use of the waters of Metzitlan Lake for generating electricity and for irrigation purposes. The company will transmit electricity to the mining districts of El Chico and Real del Monte.

PACHUCA, MEX.—Preparations are being made by the National Telephone Company to extend its long-distance system to a number of towns in this part of Mexico. It also proposes to make important improvements to its existing lines.

TONALA, CHIAPAS, MEX.—David E. Thompson, president of the Pan-American Railroad Company, has been granted a concession to utilize the water power of the Tonala River at a point near Tonala, for the purpose of generating electricity. The shops and general office of the Pan-American Railroad will be removed to Tonala. The proposed power plant will furnish electricity for lamps in Tonala.

New Industrial Companies.

THE AMERICAN ENGINE & MOTOR COMPANY has filed articles of incorporation with the Secretary of State with a capital stock of $1,000,000. The incorporators are: F. M. Shive, S. E. Roberson and W. H. Davis, of Wilmington, Del.

THE EASTERN ELECTRIC LAMP COMPANY, of Boston, Mass., has been chartered with a capital stock of $25,000 for the purpose of dealing in electrical machinery. I. N. Linnell, of Cambridge, Mass., is president, and A. A. Schaeffer, of Boston, Mass., treasurer.

THE EISEMANN MAGNETO COMPANY, of New York, N. Y., has been chartered with a capital stock of $470,000 by P. Fuller, Jr.; A. D. Weekes, Jr., and C. A. Conlon, of New York, N. Y. The company proposes to manufacture and deal in electric ignition, magnetos, etc.

THE NATURAL GAS TURBINE COMPANY has filed articles of incorporation with the Secretary of State, Dover, Del., with a capital stock of $250,000. The incorporators are: W. G. Griffin, W. D. Dupont and E. E. Griffin, of Washington, D. C.

Personal.

MR. E. G. ACHESON was awarded the Perkin gold medal of the American Electrochemical Society at a meeting held at the Chemists' Club, New York City, on Jan. 21.

MR. WALTER M. McFARLAND, acting vice-president Westinghouse Electric & Manufacturing Company, will deliver a lecture at Columbia University, New York, on April 7, on commercial engineering.

MR. T. E. SPENCE, formerly with the Lucerne County Gas & Electric Company, of Kingston, Pa., has joined the sales department of the Toronto Electric Light Company, Ltd., as power engineer.

MR. B. J. NICKLES, a prominent electrician of Madison, was elected vice-president of the Wisconsin Electrical Contractors' Association at the State convention in Milwaukee last week.

MR. A. H. BOYD, electrical engineer in charge of the motor sales department of the Fort Wayne Electric Works, has been appointed manager of the Philadelphia branch office of the Fort Wayne Company.

DR. FREDERICK BEDELL, professor of applied electricity at Cornell University, sails with his family for Algiers on Jan. 29 and will proceed later to France and Germany, returning to the university in September.

MR. E. C. FOSTER has resigned as first vice-president of the New Orleans Railway & Light Company, of New Orleans, La., the resignation becoming effective on Feb. 1. Mr. Foster will continue as a director of the company.

MR. ROBERT MATHER, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, will be placed in charge of the executive end of the company's business during the absence of Mr. George Westinghouse, who has been voted a six months' leave.

MR. EARL WILSON has resigned as director of the department of electrical and mechanical engineering of the Engineer School, U. S. A., Washington Barracks, to become electrical and mechanical engineer of the Electrical Speedometer & Dynamometer Manufacturing Company, Washington, D. C.

MR. W. E. HOLMES, superintendent of the Newton & Watertown Gas Light Company, of Newton, Mass., has resigned to become general man-

ager of the Cambridge Electric Light Company, of Cambridge, Mass. Mr. Newton has been connected with the electric-lighting service in Newton for 25 years.

MR. GIFFORD PINCHOT, whose resignation as chief forester of the United States was recently accepted by President Taft, has been appointed by the National Conservation Association to succeed Dr. Chas. W. Elliott, who retains the honorary presidency, and at whose suggestion Mr. Pinchot was selected.

MR. F. S. NORMAN, formerly connected with the New York Edison Company and with the New York Electrical Show, has accepted a position with the American Exposition, Berlin, 1910, with offices in New York. Mr. Norman will look after the exhibition of American products at the Exposition, which is to be held in July of this year.

PROF. JAMES K. HOFFMAN, in charge of the ventilating, heating, mechanical and engineering department of Purdue University, has been elected president of the American Society of Heating and Ventilating Engineers. Prof. Hoffman is the author of a work on the subject of ventilation and heating now on the press.

MR. D. McFARLAN MOORE, of Newark, N. J., addressed the Department of Electricity of the Brooklyn Institute of Arts and Sciences on Tuesday evening, January 25, in the hall of the Polytechnic Institute. The subject was "Lighting by Luminescence, or Vacuum Tube Lighting." The lecture was illustrated by a number of interesting lantern slides, together with practical demonstrations of some of the latest forms of the Moore lamp.

PROF. SYDNEY W. ASHE was operated upon for appendicitis on Jan. 11, at the Long Island College Hospital of Brooklyn. He has bees carrying on a heavy winter's work, and the attack was probably brought on by overwork. The operation was successful, and after an interval of about a month Prof. Ashe will resume his lecture courses. His condition will, however, necessitate the discontinuance, for at least a year, of his research work at Columbia University.

MR. W. W. RYDER, of La Grange, Ill., general telegraph superintendent for the Chicago, Burlington & Quincy Railroad Company, has resigned to accept a similar position with the New York Central Lines west of Buffalo, with headquarters in Chicago. Mr. Ryder has been connected with the telegraph department of the Burlington Railroad since 1887 and he had much to do with the installation of the telephone as employed on that railroad in connection with the transmission of train orders.

MR. GORDON CAMPBELL, vice-president and general manager of the Edison Electric Light Company, of York, Pa., has been elected president of the company to succeed Mr. W. F. Bay Stewart, resigned. Mr. Campbell is a graduate of Stevens Institute. In 1889 he entered the service of the Union Pacific Railway as a draftsman in the Denver shops, and afterward became superintendent of the Colfax Electric Railway Company, of that city. Subsequently he was purchasing agent and master mechanic of the North Jersey Street Railway Company; general superintendent of the United Railways, of Providence, R. I.; master mechanic and purchasing agent of the Washington Railway & Electric Company, of Washington, D. C., and vice-president and general manager of the York Railways Company. Since coming to York, Mr. Campbell has done much toward improving and systematizing the railway and lighting departments and increasing the general efficiency of the entire system.

MR. W. F. BAY STEWART, who has been president of the Edison Electric Light Company, of York, Pa., has resigned from the company, and Mr. Gordon Campbell, who has been vice-president and general manager, has been elected to succeed him. Mr. Stewart was born in Chanceford Township, York County, on Feb. 25, 1849. He attended the public schools until he was 17 years of age and later entered Pleasant Grove Academy, Lower Chanceford. He afterward entered the York County Academy. For two years he taught in the public schools and later in the York County Academy and then took up the study of law. He was admitted to the bar on Nov. 3, 1873, and in 1895 was elevated to the bench. For 10 years he was judge of the courts of York County. Besides his connection with the Edison company, Judge Stewart was president of the York Railways; president of the York Card & Paper Company; president of the York Knitting Mills Company; organizer of the Norway Iron & Steel Company as well as its president; one of the organizers of the York Haven Water & Power Company, besides being a vice-president in the concern; president and one of the chief organizers of the Valdez-Yukon Railway Company, of Alaska, and a member of the York Haven Paper Company. Since he became president of the York Railways Company in April, 1906, he built what is known as the Hanover line, costing about $650,000. In recognition of his scholarly attainments, Ursinus College has bestowed on him the honorary degree of A.M.

MR. W. F. B. STEWART.

Obituary.

MR. JOHN FARSON, a prominent banker of Chicago, died on Jan. 18. Among other interests, Mr. Farson was connected with electric railways, being largely interested in the Calumet & South Chicago Railway Company and the Southern Wisconsin Railway Company.

MR. JOHN LAKE BAKER, of Chicago, died very suddenly on Jan. 20. A number of years ago Mr. Baker was business manager of the old *Western Electrician* of Chicago, and at that time he had many friends and acquaintances in the electrical field. Of late years Mr. Baker had been engaged in other pursuits, but his electrical friends retained a pleasant memory of his unfailing cheerfulness and bright, pleasant manner. He was born in Albion, N. Y., in 1863, but had made his home in Chicago for many years.

MR. EDWARD PAYSON BRYAN, recently vice-president and general manager of the Interborough Rapid Transit Company of New York, died at San Juan, Porto Rico, on Jan. 23, of apoplexy. Born in Windsor, Ohio, 64 years ago, he began his exceptionally active career as a telegraph operator for the Louisville & Nashville Railroad at Lebanon, Ky. Later as vice-president and general manager of the Terminal Railroad Association of St. Louis, Mr. Bryan supervised the erection of the Union Terminal in that city, and he also had charge of the building of the Louisville & Nashville terminal in Louisville. While with the Interborough company he organized the operating force and placed on a working basis the entire engineering force which equipped the lines of the company, including the power house, cars, signaling system, etc. He severed his connection with the Interborough company in January, 1909, owing to impaired health.

MR. LERCY M. HARVEY, sales manager of the Milwaukee District Office of Allis-Chalmers Company, died on Jan. 19. Mr. Harvey had been in poor health for the past five months and a short time ago went to Augusta, Georgia, with the hope that the change in climate would benefit him. He died at the New Partridge Hotel in that city early on Wednesday morning from diabetes and Bright's disease. Mr. Harvey was born in Oak Park, Ill., about thirty-seven years ago. His early education was obtained in the public schools of that suburb. After completing his preparatory work he entered the University of Michigan, graduating in 1898 from the course in electrical engineering. He was a member of the Psi Upsilon fraternity and was one of the most popular men in his class. After graduation Mr. Harvey was with the Westinghouse Electric Company for about a year, after which he took up experimental work for the Siemens & Halske Company, in Chicago. Later he was in the Chicago sales office of the Northern Electric Mfg. Co. Six years ago he accepted a position in the sales department of Allis-Chalmers Company and about three years ago was made manager of the Milwaukee District Office, which position he held until his death. Mr. Harvey was a member of the Milwaukee Club and the Milwaukee Country Club. In November, 1903, Mr. Harvey married Miss Julia Stuart and for the past several years they have made their home at 625 Frederick Avenue, Milwaukee. Besides his wife, Mr. Harvey is survived by his father and mother. The funeral will be held Saturday at 12 o'clock, noon, from the home of his father, Mr. Joseph Harvey, 202 Linden Avenue, Oak Park, Illinois.

Trade Publications.

FIRE ALARM.—A complete technical description of an electrical fire-alarm system, for medium and small-size cities, is given in a booklet being distributed by Dr. Karl Georg Frank, 50 Church Street, New York, representative of Siemens & Halske and the Siemens-Schuckertwerke Company.

STEAM TRAPS.—Bulletin No. 267 of the American Blower Company, Detroit, Mich., contains a well-prepared description of steam traps. All of the details of the Detroit trap are covered fully, while many valuable suggestions are made concerning the methods by which this trap may best be utilized.

PAPER-FOLDING MACHINES.—Catalog M of the Chambers Brothers Company, Fifty-second and Media Streets, Philadelphia, is devoted to paper-folding machines and automatic paper feeders. These machines are well arranged for either direct or belt drive by means of electric motors.

CORLISS ENGINES.—An artistic catalogue devoted to Murray Corliss engines is being distributed by the Murray Iron Works Company, Burlington, Ia. In addition to showing illustrations of the completed engines, all of the important details of the engine mechanisms are illustrated and briefly described. Much information is given concerning the dimensions of the engines and the weights of the completed machines.

BUSINESS NOTES.

CHARLES L. KIEWERT COMPANY, of Milwaukee, maker of arc lamps and carbons, has opened a Chicago office at 112 South Clinton Street, with Mr. H. W. Fowzer in charge.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has opened a district office in Detroit, Mich. This office, which is in charge of Mr. A. B. Hoffman, is in the Union Trust Building.

THE PROTECTIVE ELECTRIC SUPPLY — MANUFACTURING COMPANY, of Fort Wayne, Ind., has increased its capital stock from $10,000 to $25,000, the proceeds to be used for enlarging its business. Milton B. Lorimer is president of the company, and E. M. Popp secretary.

THE DU CHARM WRENCH & NOVELTY COMPANY, Johnstown, Pa., has built a factory for manufacturing a line of wrenches for electrical construction and machinist work. A special feature of the electrician's wrench is its off-set handle for close work against walls and ceilings.

BRIDGEPORT BRASS COMPANY.—On Jan. 22 the sales department of the Bridgeport Brass Company was moved from New York to Bridgeport, to a new office building which has been provided for the general offices of the company. A branch office will be retained at the old address in New York (corner Broadway and Murray Street, Postal Telegraph Building).

THE HART MANUFACTURING COMPANY, Hartford, Conn., has taken over the electrical specialties heretofore manufactured by the Price-McKinlock Company, and hereafter will manufacture in Hartford the specialties consisting of meter connection blocks, remote control switches, O. K. fuse block connections, O. K. ground clamps and kindred devices. Mr. Granville E. Palmer, formerly with the Pettingell-Andrews Company, is taking charge of the former Price-McKinlock specialty business for the Hart Manufacturing Company.

MOORE TUBE LIGHT.—The Moore Electrical Company, Newark, N. J., reports that installations of the white Moore light for color matching in textile mills near New York during the past four months have enabled 10,000 employees to work full time, regardless of daylight or weather conditions. Heretofore on dark days they were compelled to remain idle, and it was impossible to operate several departments of the mills at night. The newest product of the Moore Electrical Company is the Moore light window, which is factory-built and semi-portable, and can be installed very readily.

TRUMP TURBINES.—Among recent shipments of turbines made by the Trump Company, Springfield, Ohio, for hydroelectric developments in Canada, was one to the High Falls Power Company, Haileybury, Ont., which consisted of two high head special horizontal turbines, designed to work under a head of 85 ft., direct connected to generators. These wheels will generate power to be furnished the gold mining properties in that vicinity. Another large shipment of Trump turbines was made to the town of Basic City, Va., for its municipal hydroelectric plant. This shipment consisted of two pairs of horizontal turbines of draft chest type driving direct connected generators. This plant will furnish the city with light and power, and is a model plant in every particular. C. Miller & Son have secured a franchise from Clermont, Iowa, to furnish electric light and power, and Trump turbines will be used in the plant for driving electrical machinery. This will be the third important hydroelectric development in which Trump turbines have been used in the State of Iowa during the past few months, and speaks for itself.

BOILER COMPOUND ORGANIZATION.—An organization of experienced boiler compound men in the country has recently been perfected to manufacture and compound chemicals for boiler treatment. Nearly all the men identified with the new firm have voluntarily given up remunerative positions elsewhere, and are concentrating their energies in the new enterprise. The new organization, which is incorporated under the name of Green, Hook & Company, with its main office in the Hudson Terminal Buildings, New York, is also operating its own branch offices in Boston, Philadelphia, Baltimore, Norfolk and Havana. Other offices will be opened as fast as capable representatives can be found. The main laboratory and works are in Jersey City, N. J., and another is under construction in Baltimore. Financially the company is backed by Jacob W. Hook, president Old Town National Bank, and owner of Jacob W. Hook & Company and C. Howard Hook & Company, manufacturers and dealers in oils, greases, etc., of Baltimore, and Stanley K. Green, of New York. Mr. Hook has been more or less identified with the compound and lubricant business during the past 30 years. The executive end of the business will be largely in the hands of Stanley K. Green, formerly sales manager of two of the leading boiler compound firms. Mr. Green's practice and experience cover both stationary and marine boiler conditions, and he has observed and tabulated the results from the use of boiler compound in thousands of various analyses. The Jersey City laboratory is in charge of John Barnes, well known as the patentee of mercury compounds for marine and stationary use, and who discovered the mechanical action which takes place from the expansion of mercury powder when it has worked in between the iron and scale. With Mr. Barnes is his son George W. Barnes, who for a long time has assisted his father in the factory of a large boiler compound firm. The Baltimore laboratory when completed will be in charge of Chester W. Ahlum, F. C. S., late chief chemist of a boiler compound laboratory, and now consulting chemist of Green, Hook & Company, and a recognized authority on feed-water treatment. With the New York office are H. E. Chapman, ex-chief engineer of the American liner *New York*, formerly chief engineer of the power plant of Harlan & Hollingsworth, Wilmington, Del., and superintendent of the Jersey Central Railroad repair shops; George W. Worth, who for 25 years was boiler compound inspector for the city of New York; George W. Laughton, a well-known engineer and recently a salesman with the Crandall Packing Company, and W. B. Pierce, a marine engineer. The Boston office, 913-914 Winthrop Building, is in charge of Sidney B. Philips, formerly with the Garlock Packing Company. The Baltimore office, Spedden Building, 913-915 South Broadway, is in charge of W. S. Fechter, a specialty man of wide engineering training and late Baltimore manager of a boiler compound firm. The Norfolk office, 41-43 Commercial Place, is in charge of Capt. E. V. White, of E. V. White & Company, one of the largest ship chandlers in the South. The Havana office, Aguacate 56, is in charge of J. E. Hernandez, who is thoroughly familiar with power plant requirements through 20 years' experience in the lubricant and boiler compound business in the West Indies. The Philadelphia office, 207 Drexel Building, is managed from New York direct. Mr. E. Q. Smith, late salesman for a boiler compound firm in Alabama, Georgia and the South, has that same territory for Green, Hook & Company. The new company has secured as advertising manager A. Eugene Michel, mechanical engineer and publicity manager, who is thoroughly familiar with the technical and practical side of engineering.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 18, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

946,531. COIL FORMER; J. Beach, Wilkinsburg, Pa. App. filed April 5, 1907. Comprises heavy end blocks, one having a laterally projecting coil former and a relatively narrow intermediate member with a laterally projecting coil former, the members being connected by dowel pins.

946,537. ELECTRIC LINE CONSTRUCTION; H. P. Davis and T. Varney, Pittsburg, Pa. App. filed June 4, 1906. For catenary constructions comprising two stationary supports, each provided with a floor flange and bolts at its upper end on the horizontal sleeve at its lower end with a tube mounted in the sleeves and a cylindrical fluted insulator on the tube.

946,540. STORAGE BATTERY; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed March 23, 1908. Impregnates the active material for alkaline storage batteries with an oxygen compound of bismuth by soaking it in a solution of a bismuth salt and heating the mass in a caustic alkali solution.

946,542. LIGHTNING-ARRESTER; W. B. Garton, Brooklyn, N. Y. App. filed Nov. 2, 1908. The interposed body material absorbs moisture from the humid air and gives up moisture to dry air, it consisting of hydroscopic and non-hydroscopic material. This offers a high ohmic resistance to the current but permits the passage of static currents.

946,544. RHEOSTAT; F. W. Harris, Wilkinsburg, Pa. App. filed Jan. 16, 1906. A frame including end castings connected by insulated rods with a plurality of resistance units on the rods, each including a pair of plates between which a plurality of spools of non-conducting material are mounted with a strip of high resistance conducting material disposed upon the spools in zig-zag form.

946,546. SECTION INSULATOR FOR ELECTRIC LINES; H. F. Hoxie, Brooklyn, N. Y. App. filed Dec. 6, 1907. An interrupted line conductor, vertical insulators and a pair of strain rods connecting corresponding ends of the insulators with brackets projecting downwardly from the insulator and attached to the line conductor.

946,549. OVERHEAD TROLLEY SYSTEM; K. Von Kando, Vado Ligure, Italy. App. filed May 4, 1908. Two conductors, close together and a yielding device for maintaining a predetermined position between them.

946,576. RESISTANCE TERMINAL; F. D. Hallock, Wilkinsburg, Pa. App. filed Jan. 3, 1906. A cast metal resistance unit with a flexible terminal cast into the extremity thereof, the outer portion of the strip terminal being slotted.

946,590. ELECTRIC TROLLEY LINE CONSTRUCTION; T. Varney, Pittsburgh, Pa. App. filed June 4, 1906. For bow-trolleys. The trolley conductors form a V-shaped junction and a plurality of auxiliary diverging guard wires are located between them and support cross pieces clamped to the ends of the wires and to the trolley supports.

946,597. SAFETY THERMAL CUT-OUT OR SWITCH; J. W. Fowle, Wellesley, Mass. App. filed Dec. 5, 1907. Comprises a plurality of fingers, a contact piece, puncturable insulating material between the fingers and the contact piece, which is destroyed between all the fingers whenever it is broken down between any one of the fingers and the contact piece.

946,623. INSULATOR FOR ELECTRIC LINES; T. Varney, Pittsburgh, Pa. App. filed June 8, 1907. For supporting the messenger cable. Consists of a body of insulation, with a metal cap having a side groove and partially closed sleeves which continue the groove and clamp the wire.

946,624. OVERHEAD LINE STRUCTURE; T. Varney, Pittsburgh, Pa. App. filed June 8, 1907. For high-voltage railway service, to do away with bracket arms. A span wire is arranged between supports in which a cross bar is suspended, said bar being connected to said supports by wires, and a messenger cable is supported by the cross bar hangers for suspending the conductor.

946,625. TROLLEY HANGER; T. Varney, Pittsburgh, Pa. App. filed July 8, 1909. A hanger for electric conductors, comprising a conductor clamp, an overhead support and a triangular structure between the two parts, with one side loosely secured to the other two.

946,643. ELECTRIC STOVE; H. L. Millspaugh and F. S. Vincent, Reed City, Mich. App. filed July 12, 1909. A non-conducting frame carrying posts, the posts being electrically connected to produce various degrees of heat, a reversible pan in the opening in the frame, a case enclosing it having a removable cover with resistance coils connecting the posts.

946,646. OUTLET OR JUNCTION BOX; C. T. Pratt, Frankfort, N. Y. App. filed Apr. 19, 1907. For electric conduits. Includes a set of adjustable holding screws and a removable cover with keyhole slots passing over the screw heads. Details.

946,655. INSULATING TUBE; M. L. Coffey, Providence, R. I. App. filed Aug. 13, 1908. A tubular conduit with a body portion attachable to the side of the beam and the end portion bent upwardly.

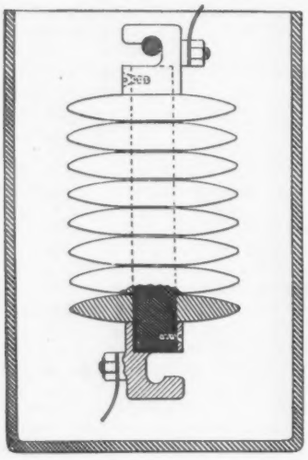
946,664. VIBRATOR FOR TELEPHONE TRANSMITTERS; J. P. Edwards, Chico, Cal. App. filed July 15, 1909. A knocker such as a pivoted hammer connected with the transmitter and caused to strike it so as to shake up the carbon.

946,680. ELECTRIC SNAP SWITCH; N. Marshall, West Newton, Mass. App. filed Sept. 21, 1909. An electric snap switch of the push button class, including a spindle carrying a rocker with cams at the end of the rocker, a lock plate with a locking notch on the spindle conducting poles on the lock plate and latches engaging the lock plate. A spring forces the latches apart, and an actuating spring throws the lock plate.

946,685. MOVABLE CONTACT FOR ELECTRIC SWITCHES; C. G. Perkins, Hartford, Conn. App. filed Jan. 14, 1909. For rotary snap switches. Comprises a pair of plates each made of flexible conducting material and having a central opening with slots in each plate. Details.

946,688. APPARATUS FOR PRODUCTION OF ZINC OXIDE; W. and H. Simm, Portico, near Prescot, England. App. filed Oct. 1, 1907. For making zinc oxide from zinc ores electrically by means of a condensing chamber, a hood and a suction fan together with an electrical furnace beneath the hood.

946,715. LIGHTING SYSTEM; W. L. Bliss, Brooklyn, N. Y. App. filed Jan. 6, 1905. Car-lighting system containing a generator, an automatic regulator therefor, a storage battery and an automatic switch to connect the storage battery and translating devices to the generator, together with a switch for throwing said devices out of operative relation with the generator and connecting them with the generator upon another train unit.



946,542—Lightning Arrester.

946,779—Insulating Chain for Pull Switches.

947,055—Electric Voltage Regulator.

946,722. INSULATOR CLAMP; W. G. Clark, New York, N. Y. App. filed Dec. 28, 1908. Two straps engaging each other surround the insulator and clamp the wire thereto.

946,725. MOUTHPIECE FOR TELEPHONES; M. Elzas, Los Angeles, Cal. App. filed April 15, 1909. Disinfecting mouthpiece consisting of a pair of circular disks, one fitted to the other, the inner disk carrying an antiseptic and adapted to engage the mouthpiece.

946,741. ELECTRIC FUSE HOLDER; J. H. Trumbull, Plainville, Conn. App. filed June 6, 1905. A base of insulation carrying clips having spring arms to hold the ends of the fuse together with a screw and nut to clamp the clip and parts in position.

946,751. ALTERNATING-CURRENT MOTOR CONTROL; E. F. W. Alexanderson, Schenectady, N. Y. App. filed June 1, 1908. The armature is short circuited so as to operate as a repulsion motor for low speed and the short circuit opened for high speeds, with a cut-out switch for cutting out either one of the pair of such motors and for preventing establishment of the high-speed connection when one motor is cut out.

946,753. ELECTRIC VEHICLE; F. E. Case, Schenectady, N. Y. App. filed Sept. 11, 1909. Current collecting devices for connecting them to the power circuits, a valve for controlling the movement of each connecting device into its connecting position for closing the switch and a valve for controlling the opening of the switch. The collecting devices and switches are pneumatically operated.

946,779. INSULATING CHAIN FOR PULL-SWITCHES; H. Hubbell, Bridgeport, Conn. App. filed May 17, 1909. The chain has linked bars and an insulating rod with caps at its ends, the chain passing through the rod and caps, and the enlarged end of each link bar being interposed between one end of said insulating rod and the wall of the cap.

946,812. PROTECTING DEVICE FOR VAPOR CONVERTERS; P. H. Thomas, East Orange, N. J. App. filed May 25, 1904. A pocket is made in the glass container adapted to be filled with a liquid into which pocket a leading in wire projects and a shield surrounds the wire as part of the material of the container.

946,813. DYNAMO ELECTRIC MACHINE; L. E. Underwood and S. R. Bergman, Lynn, Mass. App. filed Oct. 10, 1908. The core is wound with formed coils, the core having actual slots and removable teeth entering the slots, together with integral teeth separating some of the slots.

946,829. COMPOUNDING ALTERNATING-CURRENT CIRCUITS; W. Stanley, Great Barrington, Mass. App. filed May 13, 1909. Voltage regulation of alternating currents by employing two transformers with their primaries in series and in shunt to the source of voltage and the secondaries in series with each other and the load. The cores are so proportioned that one is saturated and the other unsaturated.

946,839. DISINFECTANT TELEPHONE MOUTHPIECE; J. W. Dixon, Dallas, Tex. App. filed June 14, 1909. Disinfecting cup applied to a mouthpiece. Details.

946,857. FIRE ALARM; E. Kamoureux, Montreal, Que., Canada. App. filed March 22, 1909. A perforated casing allowing the entrance of heated gases and containing a compound pivoted expansion bar with a hook for holding it raised, which automatically disengages the bar so that the bar may close a circuit and ring an alarm.

946,892. CLUSTER LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Nov. 29, 1907. Switch for controlling the lamps located within the body of the device and operated by a chain.

946,903. ELECTROLYTE AND METHOD OF ELECTRODEPOSITING COPPER; E. F. Kern, Knoxville, Tenn. App. filed Sept. 1, 1909. Electrolizes a solution containing fluo-silicate of copper.

946,905. BATTERY HOLDER; R. W. Magna, Holyoke, Mass. App. filed Feb. 11, 1909. For holding batteries in boxes. An inverted "T," made of wood, with four stays provided with recesses conforming to the shape of the batteries.

946,922. ELECTRIC LIGHTING DEVICE; J. Scharr, Nelson, Wis. App. filed March 18, 1909. Cigar lighter suspended by a cable from a trolley wheel, the later riding on a wire so that the lighter may be moved from place to place.

946,957. SIGNALING MEANS; E. J. Burke, New York, N. Y. App. filed March 26, 1908. A plurality of signals, a switch and a jack for controlling the circuit of each, a circuit closer for closing the circuit of any signaling device upon the operation of the switch and to operate on the circuit of the signaling device upon the operation of the jack.

946,982. LIGHTNING ARRESTER; A. Oleson, Toledo, Ohio. App. filed Sept. 24, 1906. For trolley wires in which the arc breaker is actuated by a solenoid. Details.

946,983. CONTACT OR VIBRATOR SCREW; W. L. Panikoff, New Haven, Conn. App. filed May 13, 1909. A screw shank with a longitudinally threaded passage and a pin holding plug screw threaded into the shank.

946,990. GROUND JOINT CONNECTION; F. E. Swope, Jr., Philadelphia, Pa. App. filed March 17, 1909. A flexible band made in sections with means for interlocking them to receive different sizes of pipe.

947,000. FIRE ALARM SYSTEM; J. P. Kelly, Basking Ridge, N. J. App. filed March 3, 1909. Central station, signal station, signaling means at each station, lighting means and a weight-controlled switch, the weight being held by an armature so that when the weight is released the light is turned on together with the signaling means.

947,055.—ELECTRIC-VOLTAGE REGULATOR; F. R. M. Cutcheon, St. Paul, Minn. App. filed Aug. 22, 1908. A plurality of adjacent expansible conductors having imperfect contact with means for opposing their expansion so that an increase in temperature due to current flowing through them increases the contact pressure and decreased the electrical resistance.

947,059. ELECTRIC CONTROLLER; A. D. Eastwood, Cleveland, Ohio, and J. S. McKee, Pittsburgh, Pa. App. filed March 2, 1909. For controlling electric motor which drives the mechanism for regulating the distance between the rolls of the mill, thus determining the size and shape of the material treated. A gage indicates the separation of the rolls and a setting device determines the position at which the motor is automatically stopped.

947,092. INDUCTION METER; C. D. Babcock, Jersey City, N. J. App. filed April 28, 1909. For measuring wireless telegraph currents by means of a primary coil, a secondary coil in inductive relation thereto and adapted to be heated by the currents of the primary coil with means for indicating the heating effects transmitted to a liquid in which the secondary is immersed, the liquid expanding under heat.

947,094. INSULATOR; E. Burton, Ansley, Neb. App. filed Feb. 4, 1909. For clamping electric wires. A bracket of uniform size and having an inverted T-shaped lower supporting portion.

947,123. ELECTRIC LAMP SOCKET; J. G. Peterson, Hartford, Conn. App. filed Oct. 25, 1909. An electric lamp socket in which the metal cap and shell are detachably secured, the shell having teeth on its inner end and carrying a cap having a corrugated ring engaging the teeth, the shell and cap being latched together.

947,154. ELECTRICAL RECEPTACLE MOUNTING; E. H. Freeman, Trenton, N. J. App. filed Aug. 3, 1908. For signboards, the supporting element having notches in the edge of the receiving hole and the receptacle body having ribs engaging the notches with a spring band sprung over the body, between one side of the supporting element and adjacent to the end portions of the ribs.

947,155. SPARKING DEVICE; I. W. Giles, New Bedford, and C. W. Tobey, Fairhaven, Mass. App. filed March 3, 1909. For ignitors, including a transformer coil, an electromagnet, a spring carrying an armature and a pair of contacts, a pair of fixed contacts, one movable and one fixed contact being in normal engagement and the other contacts brought into engagement by the movement of the armature toward the magnet which at the same time separated the first-named contact.

947,165. TROLLEY WHEEL; B. F. Smith, Natrona, Pa. App. filed Feb. 27, 1909. A sectional wheel with a detachable wearing member replacable when worn. Details.

947,185. INSULATING SUPPORT; G. B. McBean, Chicago, Ill. App. filed Aug. 26, 1909. For signboards. The securing means include a screw thread on the support, a shoulder on the support, a sleeve carried by the screw thread, lugs on the sleeve engaging the screw thread on the support, the screw threads on the support having longitudinal grooves so as to permit the engagement between the sleeve and the screw threads at any point lengthwise thereof.

947,208. ALARM AND SIGNALING SYSTEM; G. M. Willis, Chicago, Ill. App. filed May 7, 1906. Watchmen's signaling and fire-alarm system in which the substation includes a break wheel operated by a spring motor which is wound to cause one revolution of the wheel, together with separate means for winding the wheel so as to cause a plurality of revolutions of the wheel, with means associated with the separate winding mechanism for closing the circuit during part of the time while the break wheel operating mechanism is being wound.